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Home Schooling: School Choice and Women's Time Use

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Home schooling has grown rapidly and now comprises over two percent of school children. I model home schooling choice using household-level data from the 1996 and 1999 National Household Education Survey and, in a separate model, district-level data from Wisconsin. For families living in metropolitan statistical areas (MSAs), the likelihood of home schooling for high-income parents increases as academic school quality decreases; for low-income parents, as the percentage of school funds spent at the local level decreases. Outside MSAs, home schooling is popular among evangelical Protestants, although through peer effects or political influence the elasticity of home schooling demand with respect to the local percentage of evangelical Protestants decreases globally. Household characteristics are also important. The likelihood of home schooling increases when a mother's time budget is expanded by extra members of the household. The presence of a husband contributes strongly to the likelihood of home schooling outside MSAs, but inside MSAs married couples exiting the public school system have a greater tendency to substitute to private schools. Despite paying a higher implicit tuition, highly educated women are more likely to home school younger children. Their children tend to return to school in later grades.

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1. Introduction

Since the mid-1980s, the number of home schooled children has increased steadily and rapidly but research on home schooling has remained scarce. In Florida and Wisconsin, states with time series data on home schooling, the rate of increase has been remarkable. The net number of home schooled children grew at an average annual rate of 12% in Wisconsin and 15% in Florida from 1990-91 to 2000-01 (Figures 1.1 and 1.2). By a conservative estimate, 2.1% of school children, or 1,040,000 children, were home schooled nationally during the 2001-02 school year, 1.8 times the number in charter schools.[1] Though charter schools have attracted more media attention and public policy debate, home schooling is the means by which far more children are educated. In addition, understanding home schooling bridges a gap in our understanding of women's time use and the investment of parental time to children's education. As will be shown, approximately 1 in 43 mothers are home teachers. If the average time investment in home teaching is 30 hours/week and the average time investment of non-home teaching mothers in their school children is 5 hours/week, then home schooling accounts for fully one eighth of the total amount of mother's time investment in their school children, a substantial investment about which we know little. Due to the momentum and size of home schooling, it is incumbent upon economists and policy makers to better understand who chooses to home school, especially as states experiment with market-based school reforms.

[1] The number of children in charter schools in 2000-01 is 580,000, according to the Center for Education Reform (www.edreform.com/press/2002/ncsd0102.htm accessed 10/01/02). This figure includes some home schoolers. The two states with the largest number of charter schools, Arizona and California, vaulted to the top of the list by allowing home schoolers to convert their home schools to charter schools and collect public funds to maintain them (Finn, Vanourek, and Manno 2000).

Because most states do not keep records of homes schooling, a precise estimate of the number of home schooled children is difficult. The National Center for Education Statistics uses the 1999 National Household Education Survey to calculate a point estimate of 1.7% of students in spring 1999 (Bielick, Chandler, and Broughman 2001). This estimate is too low, however. NCES bases their estimate on data from a secondary interview that focused on one or two children per household, rather than on all children in a household. In other words, NHES is not making use of data in a context in which the number of observations is low. By using all the data, I estimate that 1.96% of children are home schooled, rather than 1.7%. Multiplying by a conservative estimated annual rate of increase of 3% gives an estimate of 2.1% home schooled out of the total population of children.

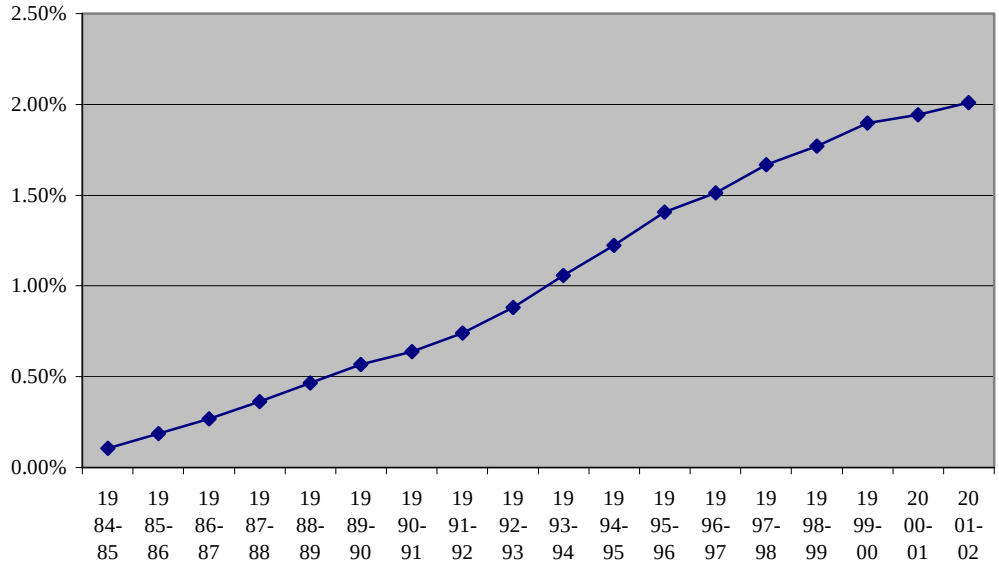


Figure 1.1: Percent School children Home Schooled in Wisconsin, Grades 1-12, 1984-95 to 2001-02

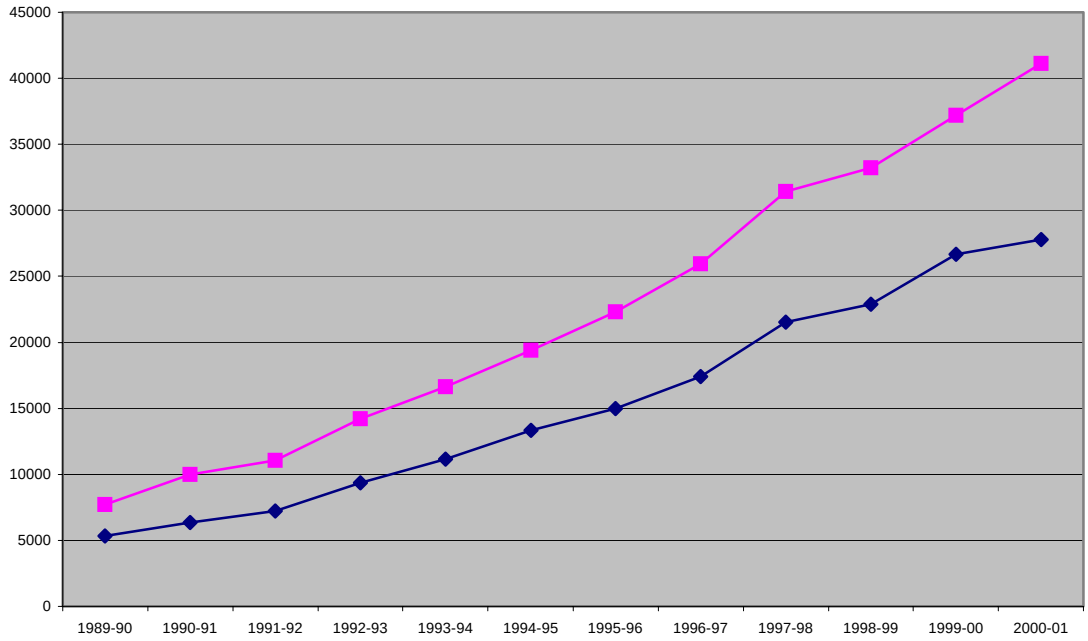


Figure 1.2: Number of Families & Students (ages 5-18) Home Schooled Registered with Florida Superintendents, 1989-90 to 2000-01

In spite of its growth, little is known about which families home school or about the effects of state education policies and household characteristics on home schooling. Sociologists have offered case studies of home schooling families, and a few sociologists (e.g. Bauman 2001) and economists (Houston and Toma 2001, Belfield 2002) have used data to address this question. Descriptive statistics and descriptive regressions have characterized the probability that a *child* is home

schooled, but no one has previously considered home schooling at the *household* level nor modeled the effect of school quality and state policy on home schooling. I do so with household-level data from the 1996 and 1999 National Household Education Survey (NHES) and district-level data from Wisconsin.

I outline an explicit household-level utility maximization model for home schooling. By so doing, I focus the analysis on benefits and costs. Parents considering the benefits of home schooling weigh the use of a child's time in school to time spent learning at home. To understand how public and private school characteristics affect the likelihood of home schooling, it is possible to extend the burgeoning literature in public economics on the choice of private schooling (Hamilton and Macauley 1991, Lankford and Wyckoff 1992, Couch, Shughart, and Williams 1993, Lankford, Lee, and Wyckoff 1995, Downes and Greenstein 1996, Downes and Schoeman 1998). Equally important to the trade-offs facing home schooling are those affecting home teaching: the decision by a parent—almost always the mother—to allocate time to home schooling and/or among labor market work, household work, and pure leisure. This research extends the literature on the labor supply of women, particularly research on women with preschool children (Leibowitz 1974, Leibowitz, Klerman, and Waite 1992, Leibowitz and Klerman 1995, Hoynes 1996, summary by Blundell and MaCurdy 1999).

Several hypotheses purport to explain home schooling, beginning with a "grand null hypothesis" that no patterns will emerge because each case of home schooling is driven by idiosyncratic factors of parental preferences and unobserved child characteristics. On the other hand, assuming that causal effects can be found, three sets of school hypotheses and three sets of household hypotheses plausibly explain home schooling. First, home schooling may substitute for poor public school quality, whether this is academic school quality or negative peer effects from other children. Second, a narrow set of choices of local public and/or private schools may compel some parents to home school (cf. Caroline Hoxby 2000, who claims that more public school choice discourages private schooling). Third, there are political economy explanations. Home schooling may arise if it is difficult to influence public school policy, either because districts are too large to accommodate the views of a dissenting minority, because there are not enough members of the minority group to have political power in a school district, or because schools are funded and policy decisions made at the state rather than local level. District consolidation (Kenny and Schmidt 1994) and redistribution of school finance from the local to the state level are long-term trends consistent with the long-term growth in home schooling.

Of course, the decision whether to home school depends not only on some source of dissatisfaction with conventional public and private alternatives but also on household constraints and the educational impact that a mother has on her children. There are two types of explanations. First, following results from the labor supply literature, one expects that income effects on the time or money budget would increase the likelihood of home schooling, just as they increase the probability of a mother staying home with preschool children. The presence of older children, a husband, and other adults predicts an increase in the likelihood of home schooling by expanding the time budget. Similarly, women with more non-labor income, for instance government transfers or husband's earned income, may be more likely to home school as income increases initially. The effect of income on home schooling may bend backward, however, due to the market alternative of "purchasing" higher school quality through Tiebout sorting or paying private school tuition at higher incomes. Second, through substitution effects, the mother's education may affect the

likelihood that she is a home teacher, but in this case *a priori* reasoning produces ambiguous results (Leibowitz 1974). More highly educated mothers incur greater opportunity costs, but these may be counterbalanced by a greater educational impact on her children (Datcher-Loury 1988). Which of these two substitution effects dominates can only be determined empirically.

In brief, I find support for the school quality hypothesis for both academic quality and peer effects. Similarly, two versions of the political economy explanation hold: as states finance education more at the state level, home schooling increases. Also, when there are many evangelical Protestants in a rural school district, the overall level of home schooling declines, possibly due to political influence in public schools. I reject the school choice hypothesis among families living within metropolitan areas and within non-metropolitan areas, but find evidence that a lack of private schools in non-metropolitan areas is partly responsible for the higher likelihood of home schooling in those areas. Among the household hypotheses, increases in the time budget increase the likelihood of home schooling; increases in the money budget appear to have a backward-bending effect, as wealthier families substitute away from home schooling to private schooling. Generally, more educated mothers are more likely to home school younger children. Older children tend to return to school, where they can take advantage of specialized teachers. The strength of these factors varies markedly between subgroups of families. For instance, urban families base the decision to home school on different criteria than rural families; similarly high-income families differ from low-income families.

2. Home Schooling Background

2.1. History and Qualitative Evidence

"Home schooling" was the dominant means of education before the common school movement of the nineteenth century, but modern home schoolers have little connection with their nineteenth century predecessors. After the public school system became entrenched in the late nineteenth century, home schooling became a little used alternative. By the mid-twentieth century, it was limited to families living in remote areas of Alaska, a few religious groups (Mormons, Seventh-Day Adventists, and Amish), and itinerant families, such as military and missionary families, in which mothers taught children while their fathers shuttled from place to place (Lines 1991). Beginning in the 1970s, the modern home schooling movement had a dual impetus, one group "fervently religious and . . . the rest might best be characterized as the philosophical heirs of Jean-Jacques Rousseau" (Guterson 1992). Jane Van Galen, a sociologist, distinguishes between these groups (1991), writing that the essential motive for "fervently religious" fundamentalist Protestants (frequently Baptists or Pentecostals) is their belief that local public and even private schools teach a curriculum objectionable to their religion.[2] For others, home schooling is a way to provide a superior education. Sociologist Mitchell Stevens similarly contrasts religious and secular groups, based on field work (2001). Among popular home schooling magazines, newsletters, web sites, and support groups, the split between

[2] The Home School Legal Defense Association (HSLDA) is a powerful national lobbying and legal assistance organization representing the interests of religious home schoolers. It was founded by former Moral Majority leader Michael Farris and has ties to national Republican Party politics. A catalog of complaints about public schools, such as sex education and the teaching of evolution, are posted on the HSLDA web site (www.hslda.org).

two culturally distinct groups is evident. The work of Van Galen, Stevens, and others is largely descriptive, but is useful in that it indicates the potential importance of unobserved heterogeneity in home schooling. The practical consequence is the necessity of examining not only complete data sets, but also subsets separated by exogenous characteristics.[3]

During the 1980s, secular and religious home schoolers worked as allies to establish legal rights to home schooling within state educational laws. Either by favorable state judicial decisions or statutes, home schooling rights became established in every state, but each state regulates home schooling differently (Richardson and Zirkel 1991). In general, states impose minimal regulation on home schoolers, allowing them broad authority to define their approach and curriculum. At the same time, state laws restrict the data that can be collected on home schoolers. By the early 1990s, home schooling rights were well-established, the number of home schooled children continued to grow, and the alliance between secular and religious home schoolers began to fracture (Stevens 2001).

Several home school leaders claim that many parents began to home school across the country in the aftermath the massacre at Columbine High School in 1999 (e.g. Krumbine 2001; cf. Hetzel 1997, who suggests a link between school violence and home schooling). The extent of the impact of perceived school violence on home schooling is unknown. Others have suggested that parents home school because children have been expelled from school (M. Hancock 2002), have special education needs (Carothers 2001), have exceptional talent in one area (e.g. music), or have recently moved. The 1996 and 1999 NHES include survey data on why parents have chosen to home school. There are a wide range of stated reasons. The motives of home schoolers taken together have probably become increasingly varied over time, and are to some extent overlapping (Nemer 2002).

Individual home schooling families are not isolated cells. Home schooling support groups have proliferated. In such states as Florida, California, and Maryland, state law authorizes "umbrella schools" that collect tuition from home schooling families in exchange for record-keeping services, access to textbook discounts, and/or book and video libraries (S. Hancock 2002). In Florida, home schoolers have organized themselves into a statewide organization with an elected chairperson and twelve elected regional officers. Anecdotal evidence indicates a shift from an antagonistic to a cooperative relationship between home schoolers and some public and private schools. Some home schooled students enroll in courses or extracurricular activities at school. In the 1999 NHES, 19% of home schooling respondents indicated that they home schooled part-time and sent their children to school part-time. Although there is little data on how the burden of home teaching is distributed among mothers, fathers, older children, other relatives, and tutors, the existing evidence singles out the mother as the dominant home teacher. My interviews with home schooling leaders (Dickinson 2001, Krumbine 2001, Daniels 2002, M. Hancock 2002, S. Hancock 2002), a regional survey (Bliss 1989), qualitative evidence (Stevens 2001), survey data on work hours, and anecdotal evidence confirm this.
In sum, the qualitative evidence shows that unobserved parental preferences are likely to be important determinants of home schooling, and that consequently we should examine subsets of the data. Given the high opportunity costs of home schooling, home schoolers will have strong preferences for school quality, but some home

[3] Compare economist Martin Carnoy, commenting on school choice in developing countries: "Powerful locational and cultural variables may be more influential than either school or income variables in determining school attendance and sele ction choices" (1995).

schoolers emphasize an academic component of school quality—the effect of a school on their child's literacy and numeracy—and others emphasize a curricular component, for example whether evolution is taught. There may also be a role for unobserved child characteristics, but these will not necessarily undermine econometric testing. Cross-state variation in regulation ought to be examined. Finally, a reasonable simplifying assumption is that mothers are the actual or potential home teachers of their children.

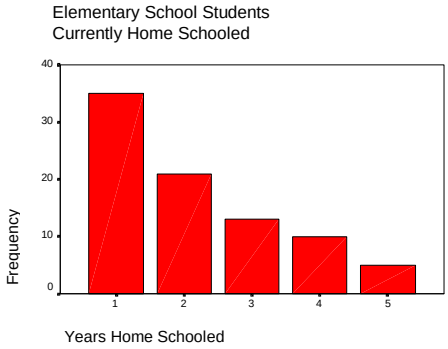
2.2 Descriptive Statistics

Because relatively little is known about which families home school, I present an overview of the household data before proceeding to form and test hypotheses. An initial look at sample means and cross-tabulations of key variables uncovers notable patterns.

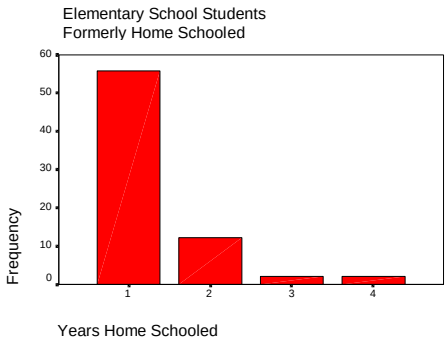
For instance, it is not true that if parents home school one child in a household, they will necessarily home school the rest, nor is this true of private schooling. See Tables 2.1a-b and 2.2. Simply summing the data from the 1996 and 1999 NHES shows that in home schooling households with more than one schoolchild, at least one other child was sent to a school in 220 of 398 cases (55%). For households with three or more children, the distribution of children home schooled or private schooled is bimodal, with peaks at one child and all children. In addition, taking advantage of a set of questions on home schooling history in the 1996 NHES, we see that much home schooling lasts less than four years (Figure 2.1a-f). Psychologist Walter Schumm (1994), in a small-scale study of home schooling in western Kansas, recognized that families mix home schooling with conventional schooling. Other than his study, these data are the first to describe within-household home schooling patterns and the duration of home schooling.

Table 2.3 shows sample data on women's labor force participation from NHES 1996 and 1999. Home teaching mothers are much more likely not to work at all than non-home schooling mothers: 46% of home teaching mothers do not work in the 1996 data compared to 20% of non-home schooling mothers, and figures are comparable for 1996. It is notable, however, that a majority of home teaching mothers work at least one month a year, and about a third work 10-12 months a year. On average, home teaching mothers who also work do so for fewer hours per week than non-home teachers. Home schooling households are only slightly more likely than average to be headed by two parents: 18% (1996) or 19% (1999) of home schooling households in the sample are headed by a single mother compared to 23% (1996) or 26% (1999) of non-home schooling households. This does not include cohabitating couples. There are two other notable facts about home schooling households (not shown in Table 2.3). First, home schooling does not seem to affect father's labor force participation, either in the decision to work or in the number of hours. Second, almost all home schooled children are the own children of the mother, i.e. the birth, adopted, step, or foster children, but almost never a niece, nephew, or nonrelative.

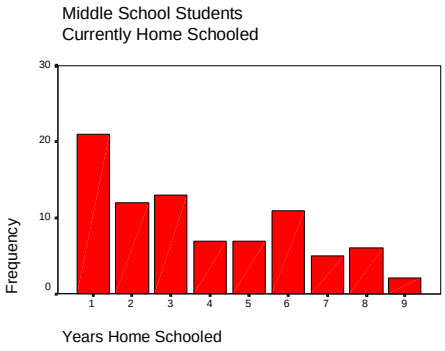
Figure 2.1a-f: Distribution of Years Home Schooled by Grade Equivalent and Current Home School Status (1996 NHES)
(N_{total} = 501; Unweighted)



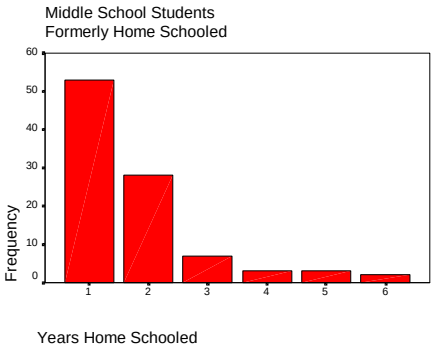
2.1a N = 84



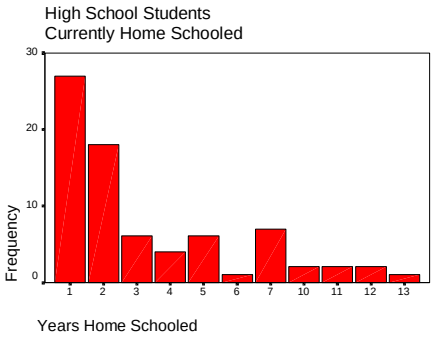
2.1b N = 72



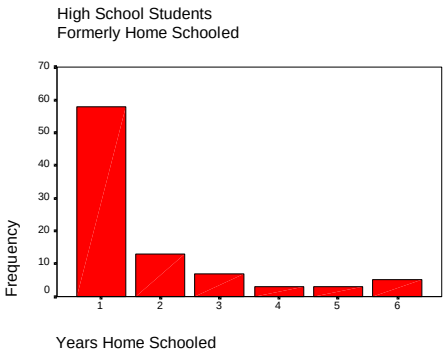
2.1c N = 84



2.1d N = 96



2.1d N = 76



2.1f N = 89

Table 2.4 summarizes a weighted average of some key child characteristics using all of the children enumerated in the NHES 1996 Household Data. It shows that on average children are more likely to be home schooled when they are a) in elementary school (ages 5-9, corresponding to grades K-4) or high school (ages 14-17, corresponding to grades 9-12); b) white, and c) non-Hispanic. The evidence on age must be interpreted cautiously, however, because the number of high school dropouts does not appear in the denominator.

Considering the survey questions on public school participation from the 1999 NHES, the within-household statistics of Table 2.1, the duration statistics in Figure 2.1a-f, and the labor force participation results of Table 2.3, it is clear that in general

home schooling families are not withdrawn from society. They may participate in the public or private school system by sharing educational responsibilities with a school, by sending other children to school while home schooling one child, or by sending children to school in a later grade. Mothers may work in the labor market part-time or part-year and home teach as well.

3. Home Schooling as School Choice and Women's Time Use

3.1. Literature Review

Before the NHES data became available, non-economists pursued research on home schooling choice by collecting their own data (Thompson 1994, Ray 1997, Hetzel 1997). Due to small sample sizes and selection issues in the data-gathering process, it has been difficult to establish causal effects. Both sociologists (e.g., Bauman 2001) and an economist (Belfield 2002) have modeled home schooling choice based on the 1996 or 1999 NHES. The results are intended as descriptive regressions, and are useful on that basis, similar to the descriptive statistics of Tables 2.3 and 2.4. A general problem with previous literature using NHES surveys, however, has been that they have focused on NHES data collected on a focal child in a secondary interview that took place after a screener interview identified the home schooling status of all children in the family. See Appendix Two for details. Parent and family characteristics are less accurate when statistics describe a focal child, because if a sibling of a non-home schooled child is home schooled, those families will be improperly classified as non-home schooling. This sampling scheme also overrepresents families who home school all their children.

Another approach has been to use district-level state data, similar to the approach taken in Section 5 on Wisconsin. As described in Section 5 and shown in Appendix One, aggregate data do not allow for the identification of household effects. An economics dissertation (Houston 1999) and subsequent working paper (Houston and Toma 2001) model home schooling choice for Kentucky and a group of ten states, using aggregate data for school years 1991-92 to 1995-96. Houston and Toma find that greater heterogeneity of income within a school district is associated with an increase in home schooling relative to public schooling. They interpret the result to mean that a greater heterogeneity of tastes leads to greater difficulty for the public schools to satisfy all families.

Apart from these few papers on home schooling itself, there has been provocative work in economics on the joint production of children's human capital by parents and schools. Carnoy (1995) applies Hirschman's (1970) analysis of "exit" and "voice" to a model of joint production. Beginning with a backward bending labor supply curve, Carnoy proposes that parents who earn wages in an intermediate range will be the most constrained for time and therefore least able to spend time investing in their children's education. He further suggests that, controlling for wages, couples and better educated parents will have greater ability to effect child quality through time investments. Overall, Carnoy concludes that better educated and higher income parents will have more ability to exercise both exit (investing in child quality by purchasing more school quality) and voice (investing in child quality through direct time investments). Note that with these definitions of exit and voice, home schooling is not an exit strategy but a voice strategy, although one pursued by direct time

investments in children, rather than by political involvement in the local public school.

Houtenville and Conway (2001) investigate the empirical relationship between school quality and parents' time investment without extending their analysis to home schooling. Nevertheless, their results are instructive. They find that, all else equal, there is an inverse relationship between the quality of the school a child attends and the parents' time investment in their children's education. This result is especially interesting in light of Carnoy's model, as it suggests that in practice even parents with greater latitude for both exit and voice tend to substitute one for the other. Extending this argument suggests that families will home school if their children would otherwise attend schools of poor quality.

3.2. Modeling Home Schooling Choice

Families are assumed to maximize a household utility function $u_{ik} = u\left(z_i, t_{if}^l, f\left(Q_i\right)\right)$. Family *i* in local area *k* receive utility from composite private good *z*, children's quality *Q*, and mother's pure leisure time t_{if}^l. There are income, time, and school attendance constraints, as well as a child quality production function. Families choose a school district in which to live and a school type (public, private, home) for each child; mothers decide how many hours to work.

Details of the model are given in Appendix One. It is sufficient here to note three key simplifying assumptions. First, only the mother's time use decision is modeled. Fathers, if present, are assumed to work year-round; their choice of hours is not affected by their wives' labor force participation or children's schooling (cf. Hill 1989). Empirical distributions of weekly hours worked for fathers with children in school and with home schooled children show no significant differences. I thereby lump non-labor income and husband's earnings into a single composite called "exogenous income."

Second, a primary job ties a household to local area *k*, but the household is free to choose a community within that region and therefore may sort among local public school districts (Tiebout 1956; cf. Nechyba and Strauss 1998, Brasington 2000, Hoxby 2000). This is a key identifying assumption. Consequently, the most local neighborhood variables, such as demographic variables based on zip codes, are endogenous. Local variables at the level of metropolitan statistical area and state variables are exogenous.

Third, there is no compensating differential for home teaching: the utility function is written as $u\left(z_i, t_{if}^l, f\left(Q_i\right)\right)$, not $u\left(z_i, t_{if}^l, t_{if}^{HS}, f\left(Q_i\right)\right)$, where t_{if}^{HS} is the time the mother spends home schooling her child(ren). This opens the model to Pollak and Wachter's general critique of household production models (1975). In producing household "commodities" from a technology of a time input and basic market "goods," there is joint production of both the commodity and the value of the experience of producing the commodity, i.e. the compensating differential. As the theoretical model is specified, the compensating differential for home schooling is absorbed by the error term of the econometric model. If the compensating differential varies over mothers, there is an omitted variable problem because a mother's attitude to home schooling is presumably an important part of the decision. To compound the problem, it is not known whether the attitude variable is orthogonal to other regressors, such as mother's education. One can construct plausible stories to explain

why, for instance, a mother who is a college dropout might have preferences that would predispose her to home schooling, apart from the cost/benefit calculations that underlie the utility maximization approach, i.e. an "attitude" factor that is correlated with both mother's education and the likelihood of home schooling. Empirically, by dividing the data set, omitted variable bias will be reduced since the attitudes of people in each subsample will be more similar to each other.

3.3 Estimation

With this household maximization model in mind, we would like to know the conditional probability that a child is home schooled in order to test hypotheses on the causes of home schooling. With a very large data set, it might be possible to partition families by the number of school children, and proceed to estimate integer count models or multivariate probit models separately for families with one child, two children, and so on. Because families with home schooled children compose a small fraction of a representative cross-section, this option is not available. Instead, I pool households with different numbers of children and estimate a discrete choice model for the probability that at least one child is home schooled, or, equivalently, the probability that a mother is a home teacher.

The model assumes three endogenous behavioral choices—school choice, women's labor supply, and residential choice. A natural estimation strategy might seem to be a system of equations or a home schooling equation with instruments for women's work hours and public school quality. This model is unworkable, however, because home schooling is modeled by a discrete choice equation, and the structural equations for the endogenous variables depend on the realized outcome of home schooling, not on the propensity to home school. For a discussion of the technical details of this problem, see Maddala (1983).

This leaves a reduced form discrete choice model. One might specify a nested logit specification that models the joint outcome of women's labor force participation and home schooling, based on a two-stage budget model in which leisure and goods are considered separable (summary in Browning 1992). In this case, however, the separability assumption is violated because the key household good, child quality, is produced directly by an input of the mother's time.

Instead of a nested structure, I rely on a single-equation probit model. Mothers' characteristics X_f affect labor force participation, wages, and educational impact. Father's characteristics X_m affect the income and, to a lesser extent, time budget· Child characteristics X_c affect the production function for child quality and the time budget. Other adults in the household (part of X_{hh}) are likely to expand the time budget and perhaps the income budget. Race (part of X_{hh}) may shift the utility function, wage rates, and the production of child quality, especially if there is stigma attached to minorities who home school. School variables S_{local} and S_{state} affect the value of substitutes for home schooling in the production of child quality. Gathering this together, we have

$$p(HS) = F(X_f, X_m, X_c, X_{hh}, S_{local}, S_{state}) \tag{3.1}$$

A linear specification with a normal error term for the propensity to home school gives a probit model:

$$HS^* = \beta_r X_i + \gamma_r S_i + \varepsilon_i \tag{3.2}$$

Both sets of parameters have a subscript *r* to allow random coefficients for subgroups in the data. In practice, this will be achieved by separating the data into mutually

exclusive subsets.

In this econometric framework, we can include variables that allow us to test several hypotheses. If all parameters are insignificant, that would support the hypothesis that strong preferences drive home schooling, but that the home schooling choice is insensitive to policy or household variables. We can also test the academic school quality hypothesis, the school choice hypothesis, and two political economy hypotheses of district size and local control of education. We can test the household hypotheses, i.e. time and income effects of other household members, and substitution effects of the mother's level of education.

4. Inference from the National Household Education Survey

4.1. Data and Specification

In both NHES data sets, I have dropped households with no own school children, single fathers, or more than one mother of a schoolchild. Dropping single father households eliminates almost no cases of home schooling. The same is true for families without own school children; home schooled children are almost always the mother's own children. Multiple mother households have about double the average number of home teachers, but few observations are lost because this household structure is rare. This leaves 14,247 households in the 1996 NHES, including 243 home schooling households (1.71%). There are 13,259 households in the 1999 NHES, including 305 home schooling households (2.30%). Based on zip code of residence, each household is merged to a set of local school variables and state school variables. All local variables are computed at the level of primary metropolitan statistical area (MSA) or non-MSA county. Descriptive statistics are presented in Table 4.1**.**

Wage and non-labor income data are absent from the NHES, but data on work hours and total household income are available. Using these data, other covariates available in the NHES data, and equivalent data from the Current Population Survey, I impute an estimate of husband's earnings plus non-labor income. I account for the uncertainty in the imputation process by using multiple imputation (Rubin 1987, 1996). Details are given in Appendix Two.

I merge four demographic variables from the 2000 census: percent of adults with bachelor's degrees, percent of children ages 5-17 living in poverty, the logarithm of the median household income of families with children, and the percent of children in private school in grades 1-12. The first three variables account for local peer effects; the last is used to check robustness of results on the effects of private school choice. I compute three variables for local school choice and quality using the 1995-96 Common Core of Data (CCD): the logarithm of the weighted average of per pupil expenditures across districts, the median district size of one grade of students (e.g., fourth grade), and a public school choice index derived as $(1-HERF_m)$, where $HERF_m$ is the Herfindahl index of enrollment in local public school districts.[4] An additional local school variable that I derived from the 1997-98 Private School Survey is the number of private schools per schoolchild. Finally, there are four state-level variables: the average state math score from the National Assessment of Education

[4] The Herfindahl index is a popular if imperfect measure of school choice. See Jepsen (1999), Hoxby (2000), and summary in Belfield and Levin (2002).

Progress (NAEP), the percent of school revenue generated at the local level, a set of four indicator variables corresponding to progressively stricter state legal standards for home schooling, and an indicator variable for the presence of separate elementary and high school districts in the state.

To test the academic school quality hypothesis, I use the state-level NAEP average math score, a broad measure of school quality. To check the robustness of the results, I estimate models with local per pupil expenditure in its place, and with both variables. The predicted effect is negative. To test the school choice hypothesis, I use the local choice (Herfindahl) index for public schools, and the number of private schools per child for private schools. Again, the predicted effect is negative. To test the two variations of the political economy hypothesis, I use local median district size, entered as linear and quadratic terms to allow for the possibility of an optimal district size both above and below which home schooling increases.[5] Finally, to test for the substitution of voice in local public schools for the voice strategy of home schooling, I use the state-level variable for percent of local funds. If home schooling results from a lack of political influence at the local level, this coefficient will be negative.

Most household variables are either indicator variables or counts of the number of family members in particular age ranges. Time and income effects are tested by examining parameters on these count variables. Substitution effects are tested by observing the parameters on the indicator variables for different levels of a mother's education.

I present results from the 1999 data set because growth in home schooling nationally between 1996 and 1999 resulted in more observations in 1999. All regressions are weighted using Taylor series methods to obtain correct standard errors for survey data with a complex sample design. Full results for school variables are given in Table 4.2a and household variables in Table 4.2b. For each column of both tables, both sets of estimates are derived from one regression. The key causal variables discussed in the text are shaded.

Due to the strong possibility of differences between subgroups, I run probit regressions for several subdivisions of the data set in order to test the robustness of the overall results. Column one shows results using the complete 1999 NHES data set. Columns two and three show results dividing the data between households in an MSA and outside an MSA. In columns four and five, households living in MSAs are divided between those with above-median and below-median exogenous income. In columns six and seven, data are divided between families with older children (average age above 11 years) and younger children. Column eight shows a probit model in which the dependent variable is whether a family sends all its children to private school. This column uses data from 1996 because data on private schooling for all children in the household is unavailable in the 1999 NHES. These eight regressions answer our hypotheses about home schooling, and show how the answers vary across subpopulations.

4.2. Results and Inference

4.2.1. School Effects

I begin with the effect of academic school quality, summarized in the bottom

[5] The problem of the optimal size of a school district has received little attention in economics, but considerable attention in the education literature. See Jewell (1989), Fowler and Walberg (1991), Ornstein (1993).

row of Table 4.2a. In column one, I estimate the model using the complete NHES 1999 data set. The NAEP 2000 eighth grade math score variable is negative and statistically significant at the 5% level. I obtain similar results with models that use per pupil expenditure as a proxy for school quality instead of NAEP scores (not shown). When both per pupil expenditure and NAEP scores are included in the model, per pupil expenditure becomes insignificant and the parameter for NAEP is attenuated, as one would expect if expenditures are an important input to school quality. Finally, including the indicator variables to measure policy effects (not shown) does not change other parameters markedly. The parameters of the policy variables are not significant and two of three do not have the expected negative sign. This is evidence that, at least within the range of the mild policies with which home schooling is regulated, either direct home schooling policy regulations do not discourage families from home schooling or that the policy variables are endogenous, with a greater degree of home schooling in a state leading to a greater likelihood of regulation.

To check the robustness of this result across residents inside and outside metropolitan areas, columns 2 and 3 subdivide the sample between MSA and non-MSA residents. We see that the absolute value of the math score coefficient increases when only people living in an MSA are included (the p-value is .053) but falls almost to zero when only non-MSA residents are in the sample. In columns 4 and 5, I further subdivide the sample of MSA households by high and low "other income" (i.e. income not earned by the mother). There is a strong effect of math scores on home schooling for wealthier families. For a relatively wealthy family living inside an MSA, the effect of moving from a town in Minnesota, a state with the highest NAEP scores, to a demographically equivalent town in Mississippi, the state with the lowest, is to increase the likelihood of home schooling by 300%. For a more moderate change in school quality, moving from Ohio, the state at the 75th percentile of the distribution of scores, to Arizona, the state at the 25th percentile, increases the likelihood of home schooling by 49%.[6]

The school choice hypothesis receives no support, at least within MSA and non-MSA subcategories. Column 8 shows that a greater amount of public school choice decreases private schooling, confirming Hoxby's (2000) results. For home schooling, however, there is not a robust set of negative coefficients across specifications. The effect of private school supply on home schooling does not have significantly negative effects either. This holds whether I use data from the Private School Survey or Census Bureau to measure private school supply. Note that there is a greater likelihood of home schooling by families living outside MSAs than by families living in MSAs and far fewer private schools outside MSAs. I revisit the school choice hypothesis as an explanation for the between-group difference in interpreting the household parameters.

One version of the political economy explanation receives strong support. Across most specifications, an increase in the level of local funding decreases home schooling, an effect that is measured at a level of significance of usually less than 1%. This effect is statistically significant across subsamples in the 1999 data, with the exception of wealthier families in MSAs and non-MSA families. For poorer families in MSAs, these are large effects. All else equal, a family moving from a state at the

[6] Estimates of the change in the probability are obtained by holding all other variables at their means and substituting the relevant state NAEP score into the probit model. Because the specification is parsimonious in its representation of cross-state differences in institutional features of education systems, there is a possibility of some upward bias in these numbers.

25th percentile of percent local funds to the 75th percentile increases the likelihood of home schooling by 220%. There is no evidence for an effect of district size.

In the context of the results for school quality, the political economy explanation is particularly interesting. Families living outside MSAs home school at a higher rate than families living in MSAs, but none of the key causal variables are statistically significant. This opens the way for an interpretation based on preferences. Using the Wisconsin data in Section 5, I test for religious preferences and interaction effects with the number of others who share these preferences. Interaction effects show that peer or political effects are important.

Inside MSAs, there are starkly different results for mothers with greater or lesser exogenous income. First, note that the overall rate of home schooling is higher among mothers with less exogenous income: approximately 2.3% compared to 1.9%. For wealthier families, who have more recourse to live in higher quality public school districts or to send their children to private schools, home schooling increases as the overall level of public school quality declines. This result lends support to Carnoy's (1995) contention that parents with higher incomes will have a stronger ability to exercise exit and confirms Houtenville and Conway's (2001) results that exit is a substitute for voice: the difference between the levels of home schooling by wealthier and poorer mothers indicates that those who have the means to escape poor quality public schools prefer do so by exit strategies of sending their children to better schools rather than by the voice strategy of home schooling. The ability to exercise the exit strategies favored by these families will be attenuated as the overall distribution of school quality shifts down. The propensity to use private schools (column 8) as a substitute for lower quality local public schools is also increased by poor public school quality. Local control does not affect home schooling among these mothers because they have the means to exploit the existing variation in schools or school districts by voting either with their feet or their tuition dollars. They do not need to exercise voice in local districts. For poorer mothers, as Carnoy (1995) explains, both exit and voice options are more constrained. As the results here indicate, exit is much more constrained than voice, and so the potential to invest time in local school governance through a voice strategy is much more important. There is no measured effect of academic school quality for this group. A broad measure of school quality may affect these families less because they are constrained to consume below-average public school quality, and variations along this range of school quality are unimportant for families with high preferences for child academic quality. Alternatively, they may emphasize non-academic aspects of school quality.

4.2.2 Household Effects

Families need some reason to home school—and the evidence from the school parameters shows that home schooling is due to poor school quality or a lack of local political control. Mothers contemplating home schooling could not be so constrained by time and money budgets that home teaching would be impossible. To test this, we examine Table 4.2b, which shows household parameters. There are two hypotheses on the time use side: time/income effects of household structure and substitution effects of mother's education. The results show that both sets of variables exert strong effects on the likelihood of home schooling.

A hypothesis of time effects receives strong support as long as other adults and non-own children in a household expand the time budget of a mother. There are positive and significant coefficients for the number of other adults and non-own children across most specifications. There are similarly strong results for the number

of preschool children, which suggests that home schooling and care of preschool children are complements in production. This may also explain why home schooling decreases at middle school ages (at least in the survey data): as the youngest child in a family becomes eligible for kindergarten, the implicit tax of preschool children is eliminated, and it becomes more lucrative for a mother to spend more hours in the labor force.[7] It is thus more likely that older children, who may be approaching middle school grades, will be sent to school instead of home schooled. Income effects on the money budget also receives support, although in the presence of private school alternatives, there seems to be substitution to private schools. The effect of having a father in the household, the most important variable measuring income effects in reduced form, is positive and significant at the 5% level only for families living outside MSAs, where there are few private school alternatives. For families inside MSAs, the presence of a father does not make a measurable difference, probably due to substitution to private schools. Column 8 shows that having a father present greatly increases the likelihood of private schooling. Taken together, these results suggest that a lack of private schooling for families outside MSAs increases home schooling relative to families living in MSAs.

There is also the important effect of mother's education to consider. Theory shows, as with married mothers of preschool children making the labor force participation decision, that there are two substitution effects: higher opportunity costs discourage home teaching, but a greater educational impact encourages home schooling. For all mothers (column 1), there seems to be support for a theory that these two effects balance: the parameter for "some college" education is greatest, although there is a gentle decline in the point estimates at the two higher levels of education, whereas mothers with less than a high school degree or just a high school degree are significantly less likely to home school, all else equal. This theory of balancing, however, results from throwing all families together: MSA and non-MSA, families with older children and younger children, and so forth. We see from examining the divided samples that the peak at "some college" in the full sample camouflages underlying effects.

In particular, comparing mothers in MSAs with high exogenous income to mothers with low exogenous income (columns 4 and 5), we see that the balancing effect appears strongly for the low income group. For high income mothers, however, the likelihood of home schooling is an increasing function of mother's education. Given higher money income, the educational impact effect dominates the opportunity cost. Roughly speaking, the father's income will be high enough to allow the mother to pay an implicit tuition to herself to home school one or more children. We also see that for parents of younger children, educational impact dominates, but not for parents of older children, for whom no pattern emerges (columns 6 and 7). For more highly educated mothers, the value of conventional schooling increases relative to a mother's educational impact as children grow older. Because of this, as columns 6 and 7 show, highly educated mothers are more likely to home school their children at younger ages and return them to a conventional alternative as they age, in time for the children to benefit both from the more specialized teaching available and from the signaling effect of a high school diploma. This pattern of home schooling is consistent both with the fact that with multiple children in a family, not all children will be home schooled even if one is, and with the fact that home schooling tends to be short-lived.

The same logic fails for less well educated mothers if there is a high

[7] See Appendix One for a discussion of the implicit tax of preschool children on mother's wages.

correlation between mother's education and child ability. If children of less well educated mothers have less to gain from a high school diploma, the opportunity costs of home schooling in high school fall, and home schooling in high school becomes relatively more likely for these children than for children of more highly educated mothers.

5. Wisconsin Case Study

By specifying a household production model and an econometric model and dividing the NHES data set in instructive ways, we have arrived at a set of conclusions about several hypotheses. Data from Wisconsin aggregated to the school district level allows us to pursue several unresolved issues. First, the household results suggest that for people in MSAs, home schooling is more likely in states with poorer academic school quality. If there is a robust relationship between school quality and home schooling, one would expect that this relationship would hold within states as well. Second, from the household data there seems to be little pattern of the effect of school variables on the likelihood of home schooling outside MSAs. Home schooling in these areas may be driven by preferences; with the Wisconsin data, we can examine the impact of religious preferences and interaction effects. Third, the NHES results weakly suggest that a variant of the school choice hypothesis explains why home schooling is more likely in rural than in urban areas: private schooling substitutes for home schooling in urban areas. Fourth, the NHES data provide little evidence that district size affects the likelihood of home schooling. As we shall see, poor school quality increases home schooling in urban but not rural areas, confirming the household-level results. In rural districts, home schooling increases as there are more evangelical Protestants in the local population, but does so at a decreasing rate, suggesting a role for peer effects or political influence in schools among this group. I find that private schooling substitutes for home schooling for evangelical Protestants in urban areas. Finally, across the range of district sizes in Wisconsin, home schooling decreases as districts get larger.

Aggregate data do not allow for confirmation of household hypotheses, even though aggregate household characteristics are available. Because students are inputs into the education process as well as consumers of education, variables like race, education, and income affect the likelihood of home schooling both by directly shifting the preferences or opportunity costs of households, and indirectly by shifting the value of schools through peer effect externalities (Lankford and Wyckoff 1992). Due to this identification problem, it can be impossible to distinguish alternate theories to interpret household characteristics. For a formal derivation of an interactions-based econometric model of home schooling that analyzes this problem precisely, see Appendix One.

5.1. Wisconsin Data and Specification

Data on public schools are widely available from state education agencies, and matching demographic characteristics are available from the Census Bureau. Many states also provide data on private schools. Reliable data on home schooling, to the contrary, are difficult to obtain. I focus on Wisconsin, which provides excellent data for public, private, and home schools.[8] In 2001-02, there were an approximately

[8] I also obtained data from Florida and ran similar models. The problem with these data, however, is

average percentage of children in home schooling, 2.01%. Public schools enrolled 84% of school children in 2001-02 and private schools enrolled 14% (compared to 10% nationally). There are more Catholics (31.6%) and mainline Protestants (15.0%) than evangelical Protestants (12.7%). For a description of the Wisconsin data, see Appendix Two.

Home schooling has been legal since 1984 (see Figure 1.1), and has grown rapidly each year until 1999-2000. The percentage of home schooled students in grades 1-12 increased at an average annual rate of 11.5% from 1990-91 to 1999-2000, and by an average annual rate of 2.85% from 1999-2000 to 2001-02. If the national trends on the short-lived nature of much home schooling hold for Wisconsin, far more children have been home schooled at some time than the roughly 2% who are currently home schooled. Home schooling at the high school level has increased steadily over the years, from 12.4% of the original cohort of home schooled children in 1984-85 to 22.5% in 1990-91 to 34.5% in 2001-02. That year, 28.0% of home schooled children were in grades 1-4 and 37.5% in grades 5-8. Home schoolers are required to register with the state, but there is no approval process and no testing or teaching requirements. Despite the laxity with which home schooling is regulated in Wisconsin, there is still some underground home schooling, but state officials believe that it is rare (Thompson 2000, Larsen 2002). There is a statewide secular support group, a statewide religious support group, and many local support groups.

In 1999-2000, 55% of the public school funds were from state revenue, 38% from local sources, and 7% from the other sources. These are roughly median values nationally; Wisconsin ranked 22nd among states in percent of funds spent at the local level. State revenue is distributed through an equalization formula and categorical grants that include, for example, special education, pupil transportation, and bilingual education (Kava and Merrifield 2001). As a group, children in Wisconsin public schools score well in national tests. In 1996, the last year in which Wisconsin participated in the National Assessment of Education Progress tests, the average math score for Wisconsin fourth graders ranked fourth among the 43 participating states. Private schools in Wisconsin are mostly religious schools, the majority of which are Catholic or Lutheran.

I regress the log-odds of the percentage of children home schooled to the percentage in public school. The public school system is composed of 426 regular school districts. There are 369 unit districts, enrolling children in grades kindergarten to twelfth grade, 47 elementary school (K-8) districts, and 10 high school districts. I exclude the high school districts and the Milwaukee school district. I also exclude two districts with missing information and 18 districts in which less than twenty students were tested on the Wisconsin Knowledge and Concepts eighth grade math tests, the academic school quality variable. This leaves 396 public school districts. Sample statistics are presented in Table 5.1.

Inference is based on four identified parameters (see Appendix One for details of identification in this model). The parameters for evangelical Protestant and its square are pure demand shifters. The linear term is expected to be positive; the

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that there are two ways by which a family can legally home school in Florida. One is to register with their local superintendent; the other is to join an umbrella school. Starting with a list of nonpublic schools (a mix of private and umbrella schools) provided to me by the Florida Department of Education, I collected my own data on the number of children enrolled in umbrella schools. Even so, there remained a measurement error problem of around 30% in the dependent variable. Because the Florida results are tainted, I do not present them in the text, but rather make comparisons in footnotes where appropriate.

squared term will be negative only if interaction effects are strong enough to induce evangelical Protestants who would otherwise home school to use public or private schools instead. The parameter on the WKCE test will be negative if low academic quality increases home schooling. This parameter reflects the influence of academic school quality controlling for demographics, which are netted out by the other control variables. It is expected to be negative. The district size variable "square root of the number of children" will be positive if larger districts increase home schooling by making political influence by minority groups on public districts more difficult. Parameters for household control variables are not identified.

5.2. Wisconsin Results and Inference

The results from several partitions of the data set for models of home and private schooling are presented in Table 5.2. The first column shows the base specification with all districts included. The parameters on math scores and district size are significantly negative. The parameters on percent evangelical Protestant show a quadratic relationship—rising at first, peaking when around 17% of the population is evangelical Protestant, and then falling. The implied maximum is within the range of the data; 28% of districts have at least this percentage of evangelical Protestants. This shows that in Wisconsin higher academic quality and larger school districts deter home schooling. There appears to be some sort of interaction effect that deters evangelical Protestants from home schooling when many of them live in the same school district.

Following the precedent with the NHES data in which families living in MSAs were distinguished from families outside MSAs, the second column shows the results of using the same specification but restricting the sample to districts with less than half of the population living in rural areas. Just as with the household data, this has a similar effect of partially controlling for unobserved heterogeneity. The results for academic school quality mirror the NHES results. The coefficient on math scores jumps 55% in absolute value, and the effect of district size is still strongly negative. The evangelical Protestant effect vanishes in these districts, however. The parameters are neither individually nor jointly significant.

Column three shows results from the same specification, but includes districts with more than half of the population in rural areas. The likelihood of home schooling is still decreasing in district size and the quadratic effect of percent evangelical Protestant is restored, but, just as with household data, school academic quality has no effect on home schooling. The two parameters are jointly significant at the 10% level; the p-value of the f-test is .086.[9]

[9] In a short regression that omits all regressors except math scores, percent evangelical Protestant, its square, district size, and the indicator variable for unit districts, the parameter on math scores is almost identical and the standard error increases. This shows that academic quality does not affect home schooling in rural districts, either using a raw measure of academic school qaulity, or net of demographic inputs. In a specification with percent evangelical Protestant entered without a squared term, the parameter is statistically insignificant at the 10% level. To the contrary, replacing the quadratic terms by the logarithm of percent evangelical Protestant produces a model with a relatively good fit. It is slightly preferred to the quadratic model by the Akaike information criterion and the Schwarz criterion. The main difference between the quadratic and logarithmic models is the effect of the percent of evangelical Protestants on home schooling beyond the implied maximum of 18% in the quadratic model. The quadratic model implies a negative elasticity of demand of home schooling with respect to percent evangelical Protestant, the logarithmic model simply a decreasing elasticity of demand. By comparison, the quadratic effect for evangelical Protestants occurs in models with Florida data, appearing in regressions on schoolchildren in grades K-6 as well as 7-12 and robust under various

There are two interpretations of the urban results in column two. The immediate, and preferred, interpretation is that secular home schoolers are influenced by school quality and will exit public schools for home schooling if they live in districts with poor public schools. A drop in math scores from the mean in these districts to one standard deviation below the mean increases home schooling by a modest 9.3%, from 2.3% to 2.5%, all else equal (excluding consideration of private schools). A decrease from two standard deviations above to two standard deviations below increases home schooling by 44%, from 1.9% to 2.7%.

The alternate interpretation posits that the results are generated by "Tiebout bias"—in accordance with the Tiebout model, families seeking to use public schools will move to districts with high-quality schools; families intending to use private or home schools will sort into low-quality districts (Tiebout 1954). The effect of math scores on home schooling would then arise from sorting, rather than schooling, effects (Goldstein and Pauly 1981; Rubinfeld, Shapiro, and Roberts 1987). In this instance, however, Tiebout bias is an unappealing explanation, for three reasons. First, as the descriptive statistics from the NHES show, home schooling is often short-lived and does not necessarily begin in kindergarten. Unless families are moving frequently and timing their moves to coincide with stints of home schooling, Tiebout sorting is not likely to exert a large influence. Second, because siblings of home schooled children are often sent to school, and parents tend to invest roughly equal amounts in their children's education (Behrman, Pollak, and Taubman 1995), it is unlikely that a parent willing to invest large amounts of time into one child would send another child to an inferior public school district. Third, the top-heavy equalization formula in the Wisconsin public schools implies that local taxes for public schools do not exert much influence in residential decisions. It is possible that school quality is capitalized into housing prices, but this would not be as strong an effect.

Districts with more rural residents show a different pattern than less rural districts. It appears that home schooling in these districts is driven by the geographic dispersion of evangelical Protestants. On the other hand, even though evangelical Protestants are almost as common in less rural districts as they are in more rural districts—the unweighted district mean differs only by 13% compared to 14%—religion does not appear to be a demand shifter in less rural districts. A possible explanation for one or both of these phenomena is that evangelical Protestants form private schools when they are spatially concentrated. By this school choice hypothesis, private schooling substitutes for home schooling when there are many evangelical Protestants in the same rural district and at all levels in urban districts. If this hypothesis is true in both cases, in a log odds model of private schooling to public schooling, in rural districts the squared term will be positive, and in urban districts the linear term will be positive.

I regress the log-odds of private schooling to public schooling on the same variables in the home schooling equation, plus percent mainline Protestant and percent Catholic.[10] Results are given in columns 4 and 5 of Table 5.2. For evangelical Protestants in urban districts, there is a strongly significant positive effect on private schooling. In the context of the results for home schooling in column 2, this suggests

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specifications. The function peaks around 27%, within the range of the Florida data since Florida has a greater percentage of evangelical Protestants than Wisconsin. A logarithmic model also fits the Florida data well.

[10] Because the dependent variable in these regressions is based on census data available at the county level, the variances are calculated to reflect correlation within school districts in the same county. District-level data will become available in 2003 when the School District Data Book is released.

that private schooling substitutes for home schooling in urban districts.

In column 5, there is no significant effect of evangelical Protestants on private schooling in rural districts.[11] There is, in other words, no evidence that competition from private schools is responsible for the decreasing elasticity of home schooled children with respect to evangelical Protestants in rural districts.[12]

A second explanation for the decreasing elasticity, a political economy interpretation, is that when evangelical Protestants are spatially concentrated, they can control local school boards by forming majority coalitions in school board elections. This is an appealing theory, but is unproven. For this sort of explanation to hold, the data imply that this group begins to take over school boards when only one in five local citizens belongs to such denominations.[13] This is possible, especially given the nature of school board elections. There tends to be low voter turnout, and three or four candidates are elected at once to serve four-year terms. Understanding to what extent political control by evangelical Protestants diminishes home schooling requires further research.

A third explanation stresses the importance of local support groups to home schooling. If home schooling depends not only on individuals with strong reasons (and reasonable opportunity costs) to exit conventional schools, but also on a community of similarly minded families to provide help through local support groups, then a home schooling model could generate an interaction effect without invoking public school peer effects. The externalities would take place within the community of home schoolers, not at the schools. The problem with this explanation is that the most intuitive expectation it generates is a quadratic function with a positive linear term and a positive squared term, since having more like-minded families nearby should encourage rather than discourage home schooling.

The fourth explanation reverts to a school quality explanation, but emphasizes the subjective "quality" of peers as perceived by parents. It supposes, as in the model, that evangelical Protestants are more satisfied in attending public schools that enroll more evangelical Protestants. Short of the ability to control the school board, peer effect externalities in public schools may exert a large enough influence to dissuade further families from home schooling.

Finally, the Wisconsin results show that in both urban and rural districts, home schooling decreases as district size increases. This is the opposite of the predicted result that district consolidation has increased home schooling by making political influence on public districts more difficult. Since Wisconsin districts are relatively small, however, it lends some credence to the idea of an optimal district size that is larger than most Wisconsin districts. The optimal size result, however, did not emerge from the household data.

6. Conclusion

Using a household model and new data from the National Household

[11] In a specification with a linear term only, the effect is also statistically insignificant.

[12] Downes and Greenstein (1996) find that evangelical Protestant schools entering the schooling market in California in the 1970s were not responsive to demand for academic school quality. This is consistent with the view that home schooling and private schooling among evangelical Protestants in Wisconsin are alternative forms of avoiding public schools but that neither is responsive to academic school quality.

[13] As explained in Appendix Two, however, the Religious Congregations and Membership survey has a downward bias.

Education Surveys (NHES) merged with secondary data sets, and an interactions-based model and data from the Wisconsin Department of Public Instruction, I uncover a mosaic of new conclusions about home schooling. Moving beyond sociologists' descriptions of the cultural aspects of home schooling, I show how home schooling is affected by the local education market and household variables. In discussing the cultural aspects of home schooling, sociologists have emphasized how cultural factors like religious predispositions characterize home schooling families. Despite unobserved heterogeneity among parents, I do not find home schooling to be not so idiosyncratic that it defies explanation by econometric models.

It is immediately clear that home schoolers are not withdrawn from society. I find that 55% of multiple-child households that home school one child send at least one other child to a school. Furthermore, stints of home schooling tend to be short-lived, often lasting or having lasted four years or less, even among older children. A majority of home teaching mothers work at least part-year. Given these facts, it is likely that in deciding whether or not to home school a particular child in a particular year, families are responsive to local education markets.

The question is how parents respond to the local education market, or, equivalently, why some parents choose home schooling over public and private alternatives. I test three sets of schooling hypotheses: a school quality hypothesis that predicts that parents are more likely to teach their children at home as school quality falls; a school choice hypothesis that predicts that as choice in the local market for schools decreases, parents are more likely to opt out in favor of home schooling; and a political economy theory that predicts that as it becomes more difficult for parents to exercise voice in public schools, they are more likely to choose home schools.

I find support for the school quality hypothesis in both the 2001-02 Wisconsin data and the 1999 NHES, although families emphasize different aspects of school quality depending on whether or not they live in metropolitan statistical areas (MSAs) and their level of income. For families living in MSAs (or areas with less than half the population rural in the Wisconsin data), a decline in academic school quality, as measured by state or national math test scores, causes an increase in home schooling. In the national data, this is true only for families for whom the sum of father's income (if present) and non-labor income is relatively high. For Wisconsin families, a drop in test scores from two standard deviations above the mean to two standard deviations below increases the percentage of home schooled children by 44%, all else equal. In the national data set, for an equivalent family that moves from Minnesota to Mississippi, states at opposite poles of measured school quality, the likelihood of home schooling increases by 300%. Moving from Ohio to Arizona, the 75th percentile to the 25th percentile, increases home schooling by 49%. For rural families, academic quality does not affect the likelihood of home schooling, but there is evidence that peer effects, another aspect of school quality, do. In particular, rural home schooling appears to be dominated by fundamentalist evangelical Protestants who value public schools in which there are more families like themselves. This externality may be responsible for causing the elasticity of local home schooling demand with respect to the local population of evangelical Protestants to decrease globally. In school districts with high concentrations of evangelical Protestants, there is both a decline in the marginal propensity for home schooling and for sending children to private school, indicating that private schooling does not substitute for home schooling in these districts.

The school choice hypothesis is rejected when looking at subsets of families living within MSAs and outside MSAs. There is indirect evidence in the NHES,

however, that the lack of availability of private schools outside MSAs makes it more likely that relatively well-off married mothers living outside MSAs will home school children, unlike their counterparts in MSAs, who are more likely to send children to private schools. In Wisconsin, private schools in urban areas substitute for home schools among evangelical Protestants. The Wisconsin data also show that home schooling decreases as district size increases, but there is little evidence in the NHES that the size or number of public school districts influences home schooling.

Political economy hypotheses receives mixed support in Wisconsin and strong support in the national data. Within Wisconsin, the decreasing elasticity of percent home schooled with respect to percent evangelical Protestant may be due not only to peer effects but also to direct political control. There is, however, more powerful evidence in favor of the importance of voice in local school politics: as states fund a greater percentage of education at the local level, home schooling declines. In MSAs, this is true only of families with less than the median level of exogenous income, a group who rely more on voice to obtain public school quality, since their options for exit are even more constrained than their ability to exercise voice. All else equal, a poorer family living in an MSA that moves from a state at the 25th percentile of percent local funds to the 75th percentile increases the likelihood of home schooling by 220%. Evidently, state control of education funding, a trend in school policy intended to increase equity, has also caused some families to home school.

The propensity to home school is not only responsive to observed characteristics of schools, but also to household characteristics. As in the economic literature on women's labor supply, I isolate the key variables that affect the likelihood of home schooling. In particular, an increase in the number of other adults increases the likelihood of home schooling across subsamples. This is evidence that extra family members expand the time budget of the mother, thereby increasing the likelihood of home schooling. In addition, the income effect of fathers' earnings increases the probability of home schooling if there are not private school options. For families in MSAs, however, wealthier families tend to substitute to private schools. The income effect that may at first allow a mother to reduce her hours of work and supply the necessary time inputs into home schooling eventually becomes dominated by an income effect that allows for the payment of tuition.

Finally, across several subsamples, educational impact trumps opportunity costs for home teaching mothers. This is especially evident among relatively wealthier families living in MSAs and mothers of younger children. In both cases, the likelihood of home schooling is an increasing function of the mother's education. When the children become older, mothers with at least a college degree are more likely than less educated mothers to return their children to schools. The relative educational impact of the mothers falls in comparison to the more specialized teachers in high schools. Less educated mothers are relatively more likely to home school older children, perhaps because the educational payoffs of high school are not as high for their children, who may not be as likely to attend college.

Direct home schooling regulations have no measurable impact on the propensity to home school, but we have seen that indirect policy consequences affect home schooling. The availability of good schools decreases home schooling, whether academic school quality is measured by per pupil expenditure or by higher scores on math tests. Local fiscal control decreases home schooling, although in many states court decrees have converted local fiscal control from a policy variable to a policy parameter.

In sum, the likelihood of home schooling responds to both school and

household effects. Parents living in areas with low academic school quality, perceived undesirable peer effects, or a low percent of school funds spent at the local level are more likely to home school one or more children. Given a source of dissatisfaction with conventional schools, the likelihood of home schooling also depends critically on time and income effects that expand a mother's budget constraint. Her educational impact relative to the local school is also important. More educated mothers are more likely to become home teachers of young children, even though the implicit tuition of home schooling is higher. As their children grow older, they are more likely to return to school than children of less educated mothers.

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A. Appendix One: Formal Models of Home Schooling

A.1. Home Schooling Model for Household Data

Invoking a unitary model of household utility maximization subject to time and income constraints, the parents' household maximization problem is[1]

$$\max_{(A_c, t_{if}^l, j)} u_{ik} = u\left(z_i, t_{if}^l, f\left(Q_i\right)\right) \tag{A1.1}$$

subject to

$$y = w_{if} t_{if}^w + (y_{im} + y_i^o) = z_i + p_i^d dt_{if}^w + P^{s'} A_i \tag{A1.2}$$

$$t_f = t_{if}^w + t_{if}^{HH} + t_{if}^{HS} + t_{if}^l \tag{A1.3}$$

$$A_i = \left[c_i^{PUB} c_i^{PRV} c_i^{HS}\right]; c_i^{PUB} + c_i^{PRV} + c_i^{HS} = c_i \tag{A1.4}$$

$$Q_i = Q(X_{ic}, X_{if}, X_{im}, A_i\left(S_k\right)) \tag{A1.5}$$

In sum, the parents of family i in local area k maximize a utility function u_i (A1.1) of a composite private good z, children's quality Q, and mother's pure leisure time t_f^l. There is an income constraint (A1.2) and a mother's time constraint (A1.3). Children must attend either a local public school, private school, or home school (A1.4). Finally, child quality is produced by child, mother, and father characteristics (X), and potentially school characteristics (S), including the type of school chosen and the school district j if the school is a public school, since public school quality depends on school district (A1.5).

The utility function $\max_{(A_c, t_{if}^l, j)} u_{ik} = u\left(z_i, t_{if}^l, f\left(Q_i\right)\right)$ (A1.1) presumes separability between purchases of private goods, mother's leisure, and child quality. By this assumption, private goods are lumped into a single composite. The parent(s) make a simultaneous choice of mother's work hours t_f^w, school choice A_i, and a location decision j among local school districts. Controls for variables such as race—data in the X_i vector—may shift the utility function for different groups of people.

The budget constraint (A1.2) balances income and expenditures. Total income y is the sum of wife's earnings—exogenous wage rate w_f multiplied by endogenous work hours t_f^w and added to an exogenous term that sums father's earnings y^m (if there is a working father present) and non-labor income y^o. The expenditure side comprises private good composite z (the price is normalized to one), the price of day care for d pre-school children p^d multiplied by the number of preschool children by the mother's work hours t_f^w, and the dollar cost of schooling $P^{s_j'} A$. For public

[1] Scalars are lower-case; vectors are upper-case.

schools, the price is mediated through the local tax system. In theory, the cost of nominally free public schools includes their tax price plus the marginal cost of housing due to capitalization of local school quality plus the change in the value of other public goods that are packaged with school quality compared to the optimal package of public goods if choice were made without concern for school quality.

Fathers, if present, are assumed to work year-round; their choice of hours is not affected by their wives' labor force participation or children's schooling. Similarly, the leisure time of children does not enter the utility function. Household formation—including fertility, marriage, and divorce—is exogenous. A primary job ties a household to a local area, but the household is free to choose a school district within that area and therefore may sort among local public school districts (cf. Nechyba and Strauss 1998, Brasington 2000, Hoxby 2000).

The mother is responsible for home teaching, and, following the precedent from the household production literature, also responsible for day care of preschool children if she is not working (A1.3). Household production time $t_c^{HH}\left(n_c, X_c\right)$, which includes child care, is a function of the mother's characteristics, the number and ages of children, and the number and ages of other household members, such as grandparents. Older children and other household members may contribute to household production, reducing the contribution of the mother. To simplify, a minimum amount of necessary non-child household production time is assumed. The value of household production, proportional to this time expenditure, enters the utility function as a constant, and so is omitted from (A1.1). Home teaching time $t_f^{HH}\left(X_c, X_{hh}\right)$ is a function of exogenous characteristics: the number and ages of children home schooled, the number and ages of pre-school children, and the presence of other household members. With these assumptions, the values of t_f^w, S, and j mechanically determine the other endogenous variables z, t^{HS}, and t_f^l.

The cost of day care for pre-school children acts like a tax on the income of working women, and the presence of young children is like a negative income effect on the time endowment (Browning 1992). The tax effect can be seen by subtracting the second term on the right side of the income equation (A1.2) from both sides and combining it with the first term on the left side:

$$\left(w_{if} - p_i^d d\right) t_{if}^w + \left(y_{im} + y_i^o\right) = z_i + P^{s'} A_i \qquad \text{(A1.2}')$$

For each hour t_f^w worked, the mother deducts the hourly cost of day care $p_i^d d$ from her wage w_f. The income effect can be seen by separating household production time into non-child related household production t_f^{HH*} and child-related household production $t_f^{HH_c*}$ and subtracting child-related household production from both sides of the time constraint (A1.3):

$$\left(t_f - t_{if}^{HH*}\right) - t_{if}^{HH_c*} = t_{if}^w + t_{if}^{HS} + t_{if}^l \qquad \text{(A1.3}')$$

In words, the time available to partition between labor market work, home teaching (if chosen), and pure leisure is reduced by the amount a mother must spend caring for her children. On the other hand, the implicit tax of pre-school children encourages a mother to reduce her work hours, at least as long as the substitution effect of the tax dominates the income effect. By reducing work hours, this increases the amount of time that could be allotted to home schooling. Empirical testing shows whether the net effect of pre-school children is a complement or substitute for home schooling. There

is no compensating differential for home teaching in the model.

By $A_i = \left[c_i^{PUB} c_i^{PRV} c_i^{HS}\right]$; $c_i^{PUB} + c_i^{PRV} + c_i^{HS} = c_i$ (A1.4), all n school-aged children must be either sent to public school or private school or be schooled at home. The choice of public or private schooling versus home schooling is the key endogenous variable in the model. The production equation (A1.5) $Q_i = Q(X_{ic}, X_{if}, X_{im}, A_i(S_k))$ models the determinants of perceived school quality as a function of exogenous household characteristics X_i and endogenous school type A_{ic}. School "quality" comprises both academic and non-academic aspects of schooling. Therefore, family characteristics, particularly religion-based preferences, may shift the production function by changing the perceived value of non-academic benefits of schooling or the weighting of academic and non-academic benefits.

A.2 Home Schooling Model for Aggregate Data

In its most general form, a model for aggregate data is an interactions-based model derived from an underlying microeconomic discrete choice model over types of schooling:

$$U_{ijk} = \alpha x_{ik} + \beta x_{ik} s_{jk} + \gamma s_{jk} + \delta \bar{x}_{ijk} + \eta x_{ik} \bar{x}_{ijk} + \varepsilon_{ijk}. \qquad \text{(A2.1)}$$

U_{ijk} is the utility to family i from consuming schooling choice j in district k, x_{ik} is a set of family characteristics, s_{jk} is a set of local school variables for school type j (potentially including the tax price and/or aggregate cost of forgone local public goods for public schools, tuition costs for private schools, and opportunity costs for home schools)[2]. The term ε_{ijk} is an additive error term, and $j = 0,1,2,...,J$ since one might define different categories of private schools, such as religious and nonsectarian schools. Through peer effects, the average characteristics of children from other local families in district k are inputs to the utility function of family ijk. Consequently, demographic variables x_{ijk} are averaged over all n_{jk} children attending that type of school. The interaction terms allow different groups of families to value school and demographic characteristics differently.

The mean utility of choosing school type j for all families living in school district k will be an aggregate version of Equation A2.1:

$$\bar{U}_{jk} = \frac{1}{n_k}\sum_{i=1}^{i=n_k} U_{ijk} = \alpha \bar{x}_{ik} + \beta \bar{x}_{ik} s_{jk} + \gamma s_{jk} + \delta \bar{x}_{ijk} + \eta \bar{x}_{ik} \bar{x}_{ijk} + \frac{1}{n_k}\sum_{i=1}^{i=n_k} \varepsilon_{ijk}. \qquad \text{(A2.2)}$$

The observed percentages of children in each type will be a function of the unobserved mean utility $\bar{U}_{jk}$:

$$p_{jk} = f\left(\bar{U}_{jk}\right) = f\left(\alpha \bar{x}_{ik} + \beta \bar{x}_{ik} s_{jk} + \gamma s_{jk} + \delta \bar{x}_{ijk} + \eta \bar{x}_{ik} \bar{x}_{ijk} + \varepsilon_{jk}\right). \qquad \text{(A2.3)}$$

In many empirical applications, there are insufficient data to distinguish the average characteristics of all children in a district $\bar{x}_{ik}$ from children in a type of schooling in a district $\bar{x}_{ijk}$. If so, then the model will be

$$p_{jk} = f\left(\bar{U}_{jk}\right) = f\left((\alpha + \delta)\bar{x}_{ik} + \beta \bar{x}_{ik} s_{jk} + \gamma s_{jk} + \eta \bar{x}_{ik}^2 + \varepsilon_{jk}\right). \qquad \text{(A2.4)}$$

[2] In practice, public school districts are used in place of public schools. There is the potential for heterogeneous schools within a district, obscuring the impact of variables measured as averages and percentages. This is not so problematic if districts are small.

The parameters for the average demographic variables $\bar{x}_{ik}$ comprise $(\alpha+\delta)$. This leads to an identification problem unless there is prior information to constrain α or δ to zero. In other words, unless we know *a priori* that a demographic variable is either not a demand shifter for school choice through a household effect $(\alpha=0)$ or that it does not work through peer effects for all households $(\delta=0)$, household effects are commingled with peer effects. This problem does not arise if a demographic variable affects school choice through a household effect and through an interaction effect, e.g. only households who are themselves evangelical Protestants have as part of their utility function the total number of evangelical Protestants in the school district. In a case like this, the household effect is the measured by α and the interaction effect by η.

A logit model follows from assuming an extreme value error term. Normalizing the utility of public schooling ("school type 0") to zero, aggregating, and taking logarithms gives a log-odds model:

$$\ln\left(p_{jk}/p_{0k}\right)=(\alpha+\delta)\bar{x}_{ik}+\beta\bar{x}_{ik}s_{jk}+\gamma s_{jk}+\eta\bar{x}_{ik}^{2}+\varepsilon_{jk},\ j=1,2,...,J. \qquad \text{(A2.5)}$$

Regressions for each type of schooling may be carried out independently or, if all necessary data are available at the district level, as a SUR model. With the dependent variable in this form and a linear specification, least-squares regression is appropriate. Because each district sums over a different number n_k of children, the error term ε_{jk} is heteroscedastic. This means that ordinary least squares is inappropriate. Each observation must be weighted by

$$w_k=\left(n_k\left(\frac{e^{\beta' x_k}}{1+e^{\beta' x_k}}\right)\left(\frac{1}{1+e^{\beta' x_k}}\right)\right)^{.5} \qquad \text{(A2.6)}$$

where the parameters β in the weighting formula are derived from an unweighted first-stage regression (Greene 2000). The procedure produces consistent estimates.

B. Appendix Two: Data

B.1. Household Data

A. 1996 and 1999 National Household Education Survey (NHES). The 1996 and 1999 NHES are nationally representative, random-digit dialing phone surveys of American households sponsored by the U.S. Department of Education. The surveys are designed to focus on parental involvement in their children's education and on children's and adults' involvement in civic activities (Collins and Chandler 1997). The NHES has been conducted in 1993, 1995, 1997, 1999, and 2001. The respondent households and the survey questions change in each round. In 1996 and 1999, data were obtained on home schooling for each schoolchild 17 years old and younger. The 1996 NHES is organized as four data sets, each corresponding to a different interview. By merging two of these data sets, I have created a data set to study home schooling. The Household and Library Survey ("Household Survey") contains basic data on all household members, including their current schooling. The Parent and Family Involvement Survey (PFIS), a follow-up interview to the Household Survey, contains detailed data about a randomly selected focal child and the child's parents. By merging these data sets, I create a new data set with detailed parental information, schooling data on all school children in the household, and basic data on other household members. Although some observations are lost because not all households completed a second interview, the key advantage of this approach is that the household, rather than a focal child, is the unit of observation.

The public use 1999 NHES Parent Interview provides comparable information to the 1996 PFIS, but there is no 1999 public use survey comparable to the 1996 Household Survey that gives the schooling status of all children in the household. For this research, the U.S. Department of Education authorized the creation of a special restricted use data set that includes home schooling information on all children in the household. By merging these data with the public use data set, I have created a data set almost comparable to the 1996 data. There is not, however, data on public and private schooling of all school children in the household in 1999. The restricted use versions of both data sets provide the 5-digit zip code for each household.

NHES 1996 oversamples minorities and residents of small states. NHES 1999 oversamples minorities. Both surveys are weighted to account for oversampling and nonresponse, and raked over several dimensions, including urbanicity, census region, and home tenure, in order that the weighted sample approximates a national sample.

For the regressions, I have dropped households with no own school children, single fathers, or multiple mothers of school children. The dependent variable is "family home schools at least one child." A family was not included in this group if the only child home schooled was a 5-year old child with a grade equivalent of kindergarten.

In the 1996 data, "African-American" indicates that at least one parent is African-American or biracial. "Hispanic" indicates that at least one parent is Hispanic. In the 1999 data, racial data are available only about a focal child, so these data are applied to the household. In the interview, some respondents indicted that they did not fit any of the listed categories, but instead were of "other race." For these observations, I recoded from "other" to African-American or Hispanic if the hand-recorded "other race" fit the relevant description. For both the 1996 and 1999 NHES, these two indicator variables are not exclusive; a household may be both African-

American and Hispanic.

The indicator variable "mother dos not speak English at home" is straightforward. The indicator "mother is disabled" is derived from a set of questions about work activity. The set of indicators for mother's education compresses the range of education into 5 levels: less than high school, high school, some college, college, advanced degree. The "some college" category includes women who received vocational or college education after high school without receiving a degree, plus those who received vocational degrees or associate's degrees. The "advanced degree" category includes Master's degrees, professional degrees, Ed.D.s, and Ph.D.s.

"Father present" indicates a husband of the children's mother is present in the household. For unmarried cohabitating couples, this variable is set to zero.

An "own schoolchild" is a child who is the birth, adopted, stepchild, or foster child of the mother. Children present in the household who are the mother's nieces or nephews or non-relatives are not included in the computation of child variables for number of school children, average years spacing between school children, or average age of school children. All preschool children and school children 17 years and younger who are not own children are included in the variable "number of other children in household."

The 1996 NHES includes information on educational status of each family member. Because the NHES follows the Census Bureau definition of the composition of a household, it gathers information on college students who live in dorms, even though they live away from home. College students living in apartments are excluded. It is not clear whether college students listed on the household roster live at home or away from home. Therefore, in the 1996 NHES, I have separated college students from other adults in a household and summarized them in their own variable, "number of college students in household." The other variable, "number of other adults in household," is the sum of other adults, not including parents. This includes high school dropouts who live at home. For the 1999 NHES, it is not possible to distinguish college students from others, so they are enumerated as "other adults." "Family lives in an MSA" is straightforward. I use the zip code data from the restricted use versions of the NHES to link each household to a MSA or county for families living outside MSAs. For New England, New England County Metropolitan Areas, which are based on county boundaries, are used in place of MSAs, which are based on towns.

B. 1996-1999 Current Population Survey and Multiple Imputation of "Exogenous Income" in the NHES. Both the 1996 and 1999 NHES provide information on working hours for parents and total household income by category. These data sets neither distinguish the source of the income nor provide data on wage rates. Therefore I imputed non-labor income (i.e. income not earned by either parent), earned income of the father, and earned income of the mother by obtaining household income data on households with school children from the 1996-1999 Current Population Survey (CPS), running earnings regressions of log wage on characteristics for which I had data in both the CPS and NHES, using the resulting parametric model as a predictive equation for labor earnings in the NHES with total household income constrained to fall within the appropriate category. I used an accept/reject algorithm in which observations are accepted if they fall within the bounds of the income category and rejected otherwise.

The procedure:

1) Obtain household data from the CPS for households in which both parents

work and there are school children present.

2) Formulate a predictive model and obtain results from linear regressions of percentage non-labor income (estimated as a Tobit model), mother's log wages, and father's log wages on personal, household, and regional characteristics for which data are available in the NHES.

3) For each observation in the NHES with two working parents:

a) Obtain a predicted amount of percent non-labor income $\hat{N}LI$ by using the parameters from step two and adding a random normally distributed error term multiplied by the standard deviation of the regression from step two.

b) Obtain a predicted mother's wage $\hat{w}_f$ using a similar procedure based on the regression of mother's log wage. Constrain the wage to be greater than the minimum wage by rejecting any draw below the minimum wage and resampling.

c) Obtain a predicted father's wage $\hat{w}_m$ using a similar procedure based on the regression of father's log wage. Constrain the wage to be greater than the minimum wage by rejecting any draw below the minimum wage and resampling.

d) Check to see if $\hat{N}LI + \hat{w}_f h_f + \hat{w}_m h_m > y_{\min}$ and $\hat{N}LI + \hat{w}_f h_f + \hat{w}_m h_m < y_{\max}$. If so, accept the predicted values. Otherwise, reject the predicted values and return to step 3a.

e) Repeat steps a-d until 10 predicted values have been obtained for each observation.

4) Repeat step 3 for observations in which the mother works and the father does not and for cases in which the mother works and there is no father present. Modify the constraint in step d to be $\hat{N}LI + \hat{w}_f h_f > y_{\min}$ and $\hat{N}LI + \hat{w}_f h_f < y_{\max}$.

For some NHES observations, there is monthly but not hourly data for working women. For these observations, I multiply imputed work hours using a method similar to the imputation of wages and then followed steps 1-4.

I include these CPS variables in predictive regressions: for both mothers and fathers, years of education, work experience, work experience^2, work experience^3 (calculated as age $-$ years of education $-$ 6), indicator variables for high school dropout, professional degree, African-American, Asian, Native American, and born in U.S. At the household level, I include the logarithm of the number of children in the household, the logarithm of the number of adults in the household, indicator variables for "receives public assistance," "receives child support" (matched to NHES based on focal child data), and "receives food stamps," an indicator variable for homeowner, nine regional indicator variables based on the standard census partition of U.S. states, indicator variables for suburban, urban, rural, and "geography not given," and indicator variables for four years of CPS data.

There are 21,506 observations used to estimate the non-labor income of married couples, 11,219 observations used to estimate the non-labor income of single mothers, 22,271 observations used to estimate the log wage of married men, and 34,773 observations used to estimate the log wage of all mothers. For the mothers' wage regression, there is an indicator variable for the presence of a father and 10 additional variables in which this indicator is interacted with 10 husband characteristics.

Following Rubin (1987, 1996), multiple imputation results are obtained by performing the regressions multiple times (in my case, 10 times), using different data sets on each run, and averaging the parameter values to obtain point estimates. The

variance of a parameter in a multiple imputation regression is the sum of the average of the individual estimated variances plus the variance of the point estimates.

C. 2000 Census Data. From the long form (SF3) data, I obtained the percent of adults over 25 with a bachelor's degree or higher, the percent of children ages 5-17 living in poverty, the logarithm of the median family income of families with children, and the percent of children in grades 1-12 in private school.

These data were gathered at and merged to the NHES households at the level of primary metropolitan statistical area (MSA) or county for families living outside MSAs.

D. 1997-98 Private School Survey. The Private School Survey is a national data set maintained by the U.S. Department of Education. I deleted all schools that are vocational technical schools, daycare centers, schools in homes, and schools whose main purpose is to support home schooling (umbrella schools). I then computed the average number of students per grade, and eliminated schools with less than 10 students per grade. I calculated two data series, one based on schools with fourth grades and the other for schools with tenth grades, by summing the number of such schools over MSAs/counties. Then I divided by the population of children ages 5-17 (obtained from the census) in each area to give schools per capita. For most specifications, I used the tenth grade statistic.

E. 1995-96 and 1998-99 Common Core of Data. Using the 1995-96 agency files in the Common Core of Data (CCD), a database of school districts maintained by the U.S. Department of Education, I computed the choice index, the median district size, and average per pupil expenditures. The choice index is $(1-HERF_m)$, where $HERF_m$ is a Herfindahl index based on school enrollment, i.e. $\sum_{i=1}^{i=n} s_{im}^2$, where s_{im}^2 is the square of the share of students enrolled in district i in area m.

Like the Private School Survey data, all three data series were computed for both fourth grade and tenth grade levels. There can be a difference because in some states, there are elementary school districts (grades K-8) that are distinct from high school districts (grades 9-12). In most states, all districts are unit districts, enrolling children in grades K-12. If one does not distinguish between these, one would compute biased statistics for the choice index and median district size. For most specifications, I used the tenth grade statistic. As an additional control, I include an indicator variable (from the U.S. Department of Education) that equals one if states have elementary and high school districts.

The CCD state files are the source for the percent of local revenue. Data from the 1995-96 CCD are merged to the 1996 NHES; data from the 1998-99 CCD are merged to the 1999 NHES.

F. 1996 and 2000 National Assessment of Education Progress. These data are available from the U.S. Department of Education. This exam is given to a sample of students every two years. The subjects tested alternate so that most subjects are tested every four years. Fourth and eighth graders were tested in math in 1996 and 2000. In the past, participation has been voluntary, but most states have participated. In 1996, 43 states (of 51, including the District of Columbia) participated in the fourth grade test and 30 states in the eighth grade test. In 2000, 41 states participated in the

fourth grade test and 40 states in the eighth grade test. Since 1990, all states except South Dakota have participated at least once in both tests. Missing observations are imputed by averaging values for preceding and succeeding years if there are scores both before and after. Otherwise, a missing value is imputed by adding or subtracting an overall linear time trend. Values for South Dakota were obtained by averaging values for neighboring states.

G. Home School Legal Defense Association. The HSLDA (www.hslda.org) tracks home schooling laws and regulations in each state. They define four categories of regulation: no regulation, registration necessary, registration plus testing, registration plus testing plus parental teaching requirements. HSLDA also publishes this information annually. By using data from 1996 and 1999, I create indicator variables for these levels of regulation.

B.2. Wisconsin Data

A. 2001-02 Data from Wisconsin Department of Public Instruction. These data are available on the Wisconsin Department of Public Instruction (DPI) web site (www.dpi.state.wi.us/dpi).

The dependent variable in Table 2.2 is the logarithm of the odds ratio of the number of children home schooled in the district to the number of children in public school in the district. The DPI provides both data series. The DPI also provides enrollment data on every private school, but not on the number of children in a public school district enrolled in private school. Data for children in private school are taken from the Census Bureau, described in Section C.

The math scores are taken from the Wisconsin Knowledge and Concepts Examination. These data are district averages of the national percentile ranking of eighth graders in 2001-02.

B. Common Core of Data. Data from the DPI were matched by school district to the Common Core of Data (CCD). Using the CCD, I created indicator variables for unit (K-12) school districts. More importantly, the CCD provided the main county in which each school district was located. County boundaries are not coterminous with school district boundaries in Wisconsin. School districts may be located entirely within one county or may straddle multiple counties. There are 72 counties in Wisconsin.

C. 2000 Census Data. Percentage of African-American children ages 5-17 and percentage of Hispanic children ages 5-17 are available at the district level. Other independent variables are available at the county level and are merged at this level to school districts. These include percentage of adults over 25 with a Bachelor's degree or higher, median income of families with children, percentage of households with children who are in poverty, percentage of population living in rural areas, average number of children per family, percentage of families who are married and have children ages 0-5 and 6-17, and percentage of families who are married and have children ages 6-17 only. The Census Bureau also provides an estimate of the percentage of children attending private school. This is transformed to a log-odds ratio for use in Table 2.3.

D. 2000 Religious Congregations and Membership Survey. The Glenmary

Research Center conducts the Religious Congregations and Membership (RCM) survey in the census years. It is a direct survey of religious groups. The Glenmary Research Center divides the number of adherents 13 years and older by the total number of county residents 13 years and older (using census data on population) to obtain percentages for each county. This corrects for a bias that otherwise might arise, since some denominations count children under 13 as members, and others do not. It also groups Protestant denominations into two categories: evangelical Protestant and mainline Protestant. Lists of which Protestant denominations are classified as "evangelical" or "mainline" and data at the county level are available at the American Religion Data Archive web site (www.thearda.com). County-level data are merged to Wisconsin districts. There are three sources of error in the RCM. First, not all religious groups may return the survey. Second, congregations may miscount their membership. Third, members of a congregation may live in a different county than the church is located. The first gives a downward bias; the other two problems lead to classical measurement error. Of course, similar to the census data, there is also the problem that data collected at the county level are assigned to the school district level.

Table 2.1a: School children in Household and Home Schooled (1996 NHES)
(N=18,082; Weighted)

		Number of school children in household							
		1	2	3	4	5	6	7 or more	Total
Number of school-children home schooled	0	8,732	6,266	2,120	506	101	24	14	17,763
	1	108	52	39	4	1	1	0	205
	2		53	7	1	0	0	0	61
	3			32	8	0	0	0	40
	4				7	0	0	0	7
	5					1	0	1	2
	6						3	0	3
		8,840	6,371	2,198	526	103	28	15	18,081

Table 2.1b: School children in Household and Home Schooled (1999 NHES)
(N=14,480; Unweighted)

		Number of own school children in household							
		1	2	3	4	5	6	7	Total
Number of own school-children home schooled	0	7,392	4,783	1,498	383	77	22	6	14,161
	1	131	60	22	8	2	0	1	224
	2		47	10	0	0	0	0	57
	3			20	2	0	0	0	22
	4				10	0	0	0	10
	5					2	1	0	3
	6						3	0	3
		7,523	4,890	1,550	403	81	26	7	14,480

Table 2.2: School children in Household and Private School (1996 NHES)
(N=18,082; Weighted)

		Number of school children in household							
		1	2	3	4	5	6	7 or more	Total
Number of school-children in private school	0	7,769	5,590	1,911	444	82	25	14	15,835
	1	1,070	272	95	31	6	0	0	474
	2		510	41	10	1	0	1	563
	3			150	18	4	0	0	172
	4				23	1	0	1	25
	5					1	0	1	10
	6						3	0	3
		8,839	6,372	2,197	526	104	28	16	18,082

Table 2.3: Women's Labor Force Participation (1996, 1999 NHES)
(N=14,247 in 1996 NHES; N=13,259 in 1999 NHES; Weighted)

	No Home Schooled Children in Household		Home Schooled Children in Household	
	1996 NHES	1999 NHES	1996 NHES	1999 NHES
Percent of Total	98.2%	97.7%	1.8%	2.3%
Mother's Months Worked				
Does Not Work	19.0%	19.9%	42.7%	46.2%
Works 1-9 Months/Year	19.8%	17.2%	20.9%	21.1%
Works 10-12 Months/Year	61.2%	62.9%	36.4%	32.7%
Average Hours/Week of Working Mothers	36.5	37.1	28.1	31.0
Father in Household	77.4%	74.3%	82.5%	80.7%

Table 2.4: Sample Means of Home Schooled Children (1996 NHES)
(N=31,269; Weighted)

Age	
5 to 9	1.70%
10 to 13	1.45%
14 to 18	1.81%
Sex	
Male	1.55%
Female	1.64%
Race	
White	1.86%
African-American	0.52%
Native American	1.27%
Asian	0.63%
Hispanic	1.13%
Total	1.59%

Table 4.1: Descriptive Statistics for NHES 99
(N=13,259; Unweighted)

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
Any schoolchild home schooled	0.02	0	1	0	0.15
One or more parents African-American	0.15	0	1	0	0.36
One or more parents Hispanic	0.18	0	1	0	0.38
Mother speaks language at home other than English	0.11	0	1	0	0.32
Mother has disability	0.02	0	1	0	0.15
Mother's education: High School diploma or GED	0.27	0	1	0	0.44
Mother's education: Associate's Degree or Some College	0.32	0	1	0	0.47
Mother's education: Bachelor's Degree	0.18	0	1	0	0.38
Mother's education: Advanced Degree	0.09	0	1	0	0.29
Father present in household	0.74	1	1	0	0.44
2 own school children	0.35	0	1	0	0.48
3 own school children	0.11	0	1	0	0.31
4 or more school children	0.04	0	1	0	0.19
Average spacing of own School children	1.55	0	12	0	2.04
Average age of own school children	11.09	11	17	5	3.41
Number of own Preschool children ages 0-2	0.13	0	3	0	0.37
Number of own Preschool children ages 3-6	0.17	0	3	0	0.41
Number of other children in household	0.04	0	5	0	0.25
Number of other adults (not mother or father) in household	0.36	0	6	0	0.68
Family lives inside an MSA	0.79	1	1	0	0.41
Percent of adults with Bachelor's degree of higher in MSA/rural county.	0.24	0.25	0.57	0.05	0.08
Percent of children in poverty in MSA/rural county	0.17	0.15	0.6	0.04	0.07
Logarithm of Median Family Income in MSA/Rural county.	10.76	10.76	11.31	9.75	0.23
Private High Schools per child ages 5-17*1,000	7.9	7.19	187.27	0	6.58
Choice Index (Grade 10)	0.69	0.79	0.98	0	0.3
Elementary/High School Districts in state (indicator)	0.6	1	1	0	0.49
Median District Size/1,000 (Grade 10)	0.88	0.3	23.84	0.01	2.62
Square of Median District Size/1,000 (Grade 10)	7,644.82	90.26	569,000.00	0.1	56,587.24
National Assessment of Education Progress 8th Grade Math Score for State in 2000	225.11	227	238	193	7.23
Percent of School Revenue funded at local level in state	44.4	44	91.9	2.4	12.39

Table 4.2a Probit Results: School Variables

	Column 1: NHES 1999 Complete Data Set	Column 2: NHES 1999 Living in MSA	Column 3: NHES 1999 Living outside MSA	Column 4: NHES 1999 Living in MSA Exogenous Income > $32,360	Column 5: NHES 1999 Living in MSA Exogenous Income < $32,360	Column 6: NHES 1999 Parents of older children	Column 7: NHES 1999 Parents of younger children	Column 8: NHES 1996 Private Schooling
Family lives inside an MSA	-0.117 (0.085)					-0.175 (0.123)	-0.044 (0.119)	0.313*** (0.065)
Percent adults over 25 with college degree	-0.053 (0.553)	1.032 (0.812)	-0.834 (0.833)	2.304* (1.277)	-0.042 (1.138)	0.600 (0.754)	-0.814 (0.797)	-0.540 (0.422)
Percent children ages 5-17 in poverty	-1.810** (0.835)	-3.531*** (1.148)	1.776 (1.359)	-4.320*** (1.577)	-2.833* (1.689)	-1.626 (1.147)	-2.247* (1.243)	2.948*** (0.565)
Logarithm of median income of families with children	-0.508 (0.325)	-1.484*** (0.441)	1.171** (0.593)	-1.680*** (0.684)	-1.360** (0.659)	-0.561 (0.446)	-0.506 (0.480)	1.042*** (0.220)
Private Schools per capita*1,000	0.480 (0.317)	1.505** (0.691)	-0.163 (0.386)	1.439 (1.284)	1.439* (0.823)	0.510 (0.497)	-.081 (.304)	1.279*** (.117)
Choice Index	0.104 (0.131)	0.436** (0.180)	-0.041 (0.215)	0.426 (0.345)	0.472** (0.238)	0.086 (0.182)	0.107 (0.189)	-0.247*** (0.079)
Elementary/High School Districts in state (indicator)	0.037 (0.062)	0.083 (0.076)	-0.051 (0.120)	0.114 (0.115)	0.067 (0.107)	0.033 (0.090)	0.026 (0.087)	-0.047 (0.038)
Median District Size	-0.135 (0.354)	0.108 (0.413)	4.171 (3.810)	0.257 (0.618)	-0.062 (0.618)	0.053 (0.498)	-0.585 (0.522)	-0.019 (0.022)
Square of Median District Size	0.107 (0.154)	0.053 (0.170)	-26.936 (19.880)	0.009 (0.249)	0.120 (0.252)	0.089 (0.216)	0.212 (0.198)	0.001 (0.001)
NAEP State Math Score	-0.736** (0.376)	-0.890* (0.460)	-0.029 (0.647)	-1.261* (0.703)	-0.490 (0.645)	-0.943* (0.539)	-1.278** (0.606)	-0.767*** (0.281)
Percent of School Funds at Local Level	-0.692*** (0.237)	-0.992*** (0.294)	0.068 (0.444)	-0.477 (0.432)	-1.600*** (0.419)	-0.580* (0.330)	-0.628* (0.330)	0.323** (0.141)
Mean of Dependent Variable	.023	.021	.032	.019	.023	.024	.022	.112
Observations	13,259	10,415	2,844	5,207	5,208	6,382	6,852	13,846
F-Statistic	5.41***	5.37***	1.71**	2.67***	4.54***	3.66***	3.51***	23.60***

The variances are calculated with Taylor series methods to account for complex survey design.
+Results in columns 4 and 5 are obtained using multiple imputation techniques. Mean of dependent variable, number of observations, and f-statistic are from a representative regression.
Standard errors are given in parentheses.
*Statistically significant at the 10-percent level.
**Statistically significant at the 5-percent level.
***Statistically significant at the 1-percent level.

Table 4.2b Probit Results: Household Variables

	Column 1: NHES 1999 Complete Data Set	Column 2: NHES 1999 Living in MSA	Column 3: NHES 1999 Living outside MSA	Column 4: NHES 1999 Living in MSA Exogenous Income > $32,360+	Column 5: NHES 1999 Living in MSA Exogenous Income < $32,360+	Column 6: NHES 1999 Parents of older children	Column 7: NHES 1999 Parents of younger children	Column 8: NHES 1996 Private Schooling
Constant	5.444 (3.640)	15.935*** (4.872)	-14.984** (6.553)	18.764** (7.341)	13.709* (7.287)	6.492 (5.002)	6.647 (5.520)	-11.810*** (2.500)
African-American	-0.178** (0.086)	-0.195** (0.095)	-0.121 (0.211)	-0.183 (0.142)	-0.216 (0.143)	-0.540*** (0.149)	0.048 (0.108)	-0.172*** (0.051)
Hispanic	0.057 (0.091)	0.098 (0.103)	-0.305 (0.196)	0.116 (0.153)	0.083 (0.162)	0.045 (0.122)	0.047 (0.130)	0.064 (0.063)
Mother does not speak English at home	-0.605*** (0.157)	-0.554*** (0.170)		-0.719*** (0.249)	-0.476* (0.249)	-0.732*** (0.194)	-0.532** (0.227)	-0.190** (0.077)
Mother is disabled	0.217 (0.177)	0.213 (0.202)	0.227 (0.332)	0.141 (0.342)	0.211 (0.298)	0.300 (0.206)	-0.281 (0.412)	-0.008 (0.150)
Mother has high school diploma/GED	0.022 (0.102)	0.206* (0.124)	-0.282 (0.178)	0.268 (0.199)	0.157 (0.166)	-0.085 (0.142)	0.165 (0.147)	0.268*** (0.080)
Mother has some college	0.232** (0.095)	0.326*** (0.119)	0.128 (0.157)	0.285 (0.189)	0.380** (0.155)	0.199 (0.130)	0.298** (0.140)	0.524*** (0.081)
Mother has Bachelor's degree	0.204* (0.108)	0.338** (0.133)	0.039 (0.190)	0.359* (0.215)	0.334* (0.172)	0.017 (0.152)	0.379** (0.155)	0.784*** (0.084)
Mother has advanced degree	0.180 (0.129)	0.332** (0.153)	-0.155 (0.240)	0.452* (0.235)	0.181 (0.246)	-0.043 (0.187)	0.405** (0.180)	0.840*** (0.092)
Father present	0.111 (0.071)	0.004 (0.081)	0.411*** (0.150)	-0.040 (0.131)	0.072 (0.124)	0.065 (0.095)	0.176* (0.104)	0.271*** (0.045)
2 own school children	-0.012 (0.094)	0.066 (0.109)	-0.204 (0.186)	0.112 (0.174)	-0.002 (0.143)	-0.069 (0.137)	0.027 (0.126)	-0.239*** (0.057)
3 own school children	0.278*** (0.104)	0.437*** (0.122)	-0.173 (0.203)	0.378* (0.206)	0.492*** (0.172)	0.201 (0.145)	0.392*** (0.148)	-0.256*** (0.077)
4 or more own school children	0.496*** (0.117)	0.609*** (0.139)	0.219 (0.220)	0.736*** (0.202)	0.476** (0.198)	0.604*** (0.168)	0.460*** (0.173)	-0.278** (0.115)
Average years spacing between school children	0.042** (0.021)	0.036 (0.025)	0.068* (0.041)	0.018 (0.044)	0.055* (0.032)	0.030 (0.032)	0.083*** (0.030)	-0.035 (0.027)
Average age of school children	0.014 (0.009)	0.010 (0.011)	0.016 (0.017)	0.001 (0.017)	0.022 (0.017)	0.022 (0.024)	-0.039 (0.028)	-0.034*** (0.005)
Number of own preschool children ages 0-2	0.342*** (0.062)	0.392*** (0.072)	0.211* (0.123)	0.369*** (0.112)	0.423*** (0.108)	0.042 (0.169)	0.395*** (0.070)	-0.028 (0.050)
Number of own preschool children ages 3 and above	0.147** (0.061)	0.194*** (0.070)	0.027 (0.128)	-0.004 (0.117)	0.370*** (0.099)	0.171 (0.120)	0.164** (0.073)	-0.041 (0.044)
Number of other children in household	0.253*** (0.071)	0.294*** (0.078)	0.049 (0.227)	0.256** (0.121)	0.350** (0.116)	0.472*** (0.105)	-0.065 (0.142)	-0.230** (0.092)
Number of college students in household								0.124** (0.055)
Number of other adults in household	0.101** (0.040)	0.111** (0.045)	0.076 (0.084)	0.085 (0.067)	0.144** (0.063)	0.066 (0.052)	0.156** (0.061)	-0.034 (0.035)
Mean of Dependent Variable	.023	.021	.032	.019	.023	.024	.022	.112
Observations	13,259	10,415	2,844	5,207	5,208	6,382	6,852	13,846
F-Statistic	5.41***	5.37***	1.71**	2.67***	4.54***	3.66***	3.51***	23.60***

The variances are calculated with Taylor series methods to account for complex survey design.
+Results in columns 4 and 5 are obtained using multiple imputation techniques. Mean of dependent variable, number of observations, and f-statistic are from a representative regression.
Standard errors are given in parentheses.
*Statistically significant at the 10-percent level.
**Statistically significant at the 5-percent level.
***Statistically significant at the 1-percent level.

Table 5.1: Descriptive Statistics for Wisconsin School Districts
(N=396; Unweighted)

	Mean	Median	Maximum	Minimum	Standard Deviation
Log-Odds Home Schooling	-3.63	-3.58	-1.45	-6.41	0.64
WKCE Grade 8 National Percentile	74.05	75.00	93.00	35.00	7.39
Evangelical Protestant	0.13	0.13	0.30	0.02	0.06
Evangelical Protestant Squared	0.02	0.02	0.09	0.00	0.02
Catholic	0.31	0.27	0.66	0.08	0.11
Mainline Protestant	0.17	0.17	0.43	0.00	0.07
African-American	0.01	0.00	0.23	0.00	0.02
Hispanic	0.02	0.02	0.23	0.00	0.03
Adults over 25 with Bachelor's Degree or Higher	0.19	0.17	0.41	0.10	0.07
Logarithm of Median Family Income of Families with Children	10.83	10.84	11.24	10.16	0.16
Households with Children in Poverty	0.08	0.07	0.34	0.02	0.04
Rural	0.52	0.52	1.00	0.00	0.30
Square Root of Number of School children in Public and Home School	38.87	32.78	159.35	12.43	21.48
Average Children per Family	1.44	1.44	2.21	1.27	0.08
Percent of Families with Children 6-17 headed by Married Couple with Children 0-5	0.20	0.20	0.27	0.14	0.02
Percent of Families with Children 6-17 headed by Married Couple without Children 0-5	0.58	0.59	0.65	0.31	0.05
Unit District	0.91	1.00	1.00	0.00	0.29

Table 5.2: Home Schooling and Private Schooling in Wisconsin

	All Districts	More Urban Districts	More Rural Districts	Private Schooling: More Urban+	Private Schooling: More Rural+
Constant	0.250 (4.392)	-13.690** (6.465)	2.815 (7.827)	-24.495** (11.761)	-16.205 (15.687)
Average district math score/1,000	-7.803** (3.705)	-12.139** (4.886)	-0.145 (6.060)	6.122** (2.620)	-8.537 (5.105)
Percent Evangelical Protestant	3.154* (1.703)	0.774 (3.199)	4.514** (2.147)	2.471** (0.974)	0.812 (4.531)
Percent Evangelical Protestant Squared	-9.161* (5.277)	-3.900 (9.797)	-12.494* (6.814)		0.247 (14.672)
Percent Mainline Protestant				1.168 (1.775)	-0.030 (1.421)
Percent Catholic				1.400** (0.566)	-0.085 (0.727)
Percent African-American children	0.597 (0.679)	-0.556 (0.742)	10.268* (6.074)	-0.643 (0.511)	-3.506 (5.331)
Percent Hispanic children	1.963** (0.846)	1.616 (1.000)	0.258 (2.389)	1.061 (1.034)	2.359 (1.996)
Percent adults over 25 with Bachelor's degree	-0.358 (0.572)	-1.463* (0.752)	1.196 (1.359)	-1.659 (1.515)	-3.188 (2.707)
Logarithm of median income of families with children	-0.509 (0.425)	1.045 (0.679)	-0.656 (0.769)	1.785 (1.211)	0.850 (1.517)
Percent of households with children 5-17 in poverty	0.631 (1.975)	-0.295 (3.214)	2.138 (3.224)	6.814 (6.023)	6.800 (7.127)
Percent of households in rural areas	0.308* (0.166)	0.846* (0.471)	0.251 (0.281)	-0.849 (0.731)	-1.056** (0.509)
Square root of number of school children/1,000	-3.300*** (0.864)	-2.644*** (0.886)	-5.761* (2.970)	0.570 (0.558)	0.046* (0.023)
Average number of children per family	-0.259 (0.661)	0.004 (0.995)	-0.977 (1.030)	0.975 (1.419)	0.418 (1.653)
Percent of families headed by married couple with children 0-5 and 6-17	0.111 (1.322)	-6.900** (3.381)	0.092 (1.829)	-0.533 (4.573)	7.158** (3.187)
Percent of families headed by married couple with 6-17 only	3.395*** (1.037)	1.344 (2.470)	1.231 (1.607)	1.134 (4.289)	6.922** (3.090)
District is a unit district	0.354** (0.151)	0.276* (0.145)	0.929* (0.525)	0.045 (0.088)	-0.263* (0.1530)
Number of observations	396	187	209	187	209
Number of counties (clusters)				24	48
Mean Odds Home School or Private School	0.026	0.022	0.033	.174	.101
F-statistic	540.053	476.488	87.971	18.58	4.15

All results are second-stage results to correct for heteroscedasticity.

+The variances in columns 4 and 5 are calculated to account for correlation of districts within counties.

Standard errors are given in parentheses.

*Statistically significant at the 10-percent level.

**Statistically significant at the 5-percent level.

***Statistically significant at the 1-percent level.